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PROGRESS REPORT

Montana Mountain Goat Investigations

Along the East Front of the Rocky Mountains

Lewis and Clark National Forest

Prepared By:

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Montana Department of Fish, Wildlife and Parks

In Cooperation With

Lewis and Clark National Forest
USDA Forest Service

March 1981

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TABLE OF CONTENTS

	Page
List of Tables	ii
List of Figures	iii
Introduction	1
Study Area	2
Methods	2
Results	5
Population Distribution and Abundance	5
Seasonal Use Areas	8
Overall Mountain Goat Range	8
Winter Ranges	8
Kidding Areas	22
Breeding Areas	22
Summer Ranges	23
Nursery Areas	23
Mineral Licks	23
Physical Characteristics	24
Individual Movements	24
Habitat Description and Use	56
Seasonal Habitat Selection	56
Vegetation Analysis	56
Management Implications	57
Recommendations	57
Additional Data Needs	64
Literature Cited	66
Appendix	68

LIST OF TABLES

		Page
1.	Location and classification of mountain goats observed during helicopter survey of East Front, March 11 and 12, 1981.	6
2.	Location and classification of mountain goats observed during helicopter survey of East Front, July 11, 12 and 18, 1981.	7
3.	Information collected from six mountain goats captured at the Blackleaf Lick site during July 1981.	25
4.	Relocations of five-year-old female mountain goat, no. 52.	26
5.	Relocations of six-year-old female mountain goat, no. 82.	28
6.	Relocations of six-year-old female mountain goat, no. 72.	30
7.	Relocations of five-year-old male mountain goat, no. 85.	32
8.	Relocations of ten-year-old male mountain goat, no. 23.	34
9.	Relocations of five-year-old female mountain goat, no. 22.	36
10.	Relocations of yearling female mountain goat, no. 26.	38
11.	Relocations of yearling female mountain goat, no. 30.	40
12.	Relocations of yearling male mountain goat, no. 13.	42
13.	Relocations of yearling female mountain goat, no. 12.	44
14.	Relocations of two-year-old male mountain goat, no. 88.	46
15.	Relocations of three-year-old female mountain goat, no. 14.	48
16.	Mountain goats observed along the East Front during 1981, excluding helicopter surveys.	50
17.	Habitat information collected during mountain goat helicopter surveys of the East Front, March and July 1981.	52
18.	Location and description of mountain goat feeding sites examined during 1981.	54
19.	Plant species recorded at mountain goat feeding sites from March through September 1981.	58

APPENDIX

Appendix 1. Mountain goat observation form and code sheet. 68

LIST OF FIGURES

		Page
1.	East Front mountain goat study area, Lewis and Clark National Forest.	3
2.	Locations of mountain goats observed within the East Front study area.	9
3.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	11
4.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	12
5.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	13
6.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	14
7.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	15
8.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	16
9.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	17
10.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	18
11.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	19
12.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	20
13.	Mountain goat key winter ranges, nursery areas and mineral licks occurring on the East Front, Lewis and Clark National Forest, 1981.	21
14.	Relocations of five-year-old female mountain goat, no. 52.	27
15.	Relocations of six-year-old female mountain goat, no. 82.	29
16.	Relocations of six-year-old female mountain goat, no. 72.	31
17.	Relocations of five-year-old male mountain goat, no. 85.	33
18.	Relocations of ten-year-old male mountain goat, no. 23.	35
19.	Relocations of five-year-old female mountain goat, no. 22.	37

List of Figures, Continued

		Page
20.	Relocations of yearling female mountain goat, no. 26.	39
21.	Relocations of yearling female mountain goat, no. 30.	41
22.	Relocations of yearling male mountain goat, no. 13.	43
23.	Relocations of yearling female mountain goat, no. 12.	45
24.	Relocations of two-year-old male mountain goat, no. 88.	47
25.	Relocations of three-year-old female mountain goat, no. 14.	49

INTRODUCTION

The East Front of Montana's Rocky Mountains is experiencing a surge of oil and gas exploration activity, as well as recreational demands and impacts from other commodity extraction. The majority of activity has occurred along the East Front of the Sawtooth Range - an area rich in wildlife diversity and abundance, but limited in site-specific information for individual species. In order to avoid or minimize impacts from energy exploration and other human activities, both state and federal agencies felt it was necessary to initiate intensive wildlife studies along the East Front to gather knowledge about habitat needs and population status. One species of particular concern is mountain goats, because they are native to this area and occur entirely on Forest Service land. For these reasons, the Lewis & Clark National Forest (LCNF) and Montana Department of Fish, Wildlife & Parks (MDFWP) entered into a contract to monitor mountain goats along the Front and develop management recommendations to ensure their continued survival where human activities encroach upon mountain goat range.

Mountain goat research throughout the northwestern United States and Canada has demonstrated that mountain goats are particularly vulnerable to human activities. Mountain goat herds have declined or disappeared in Idaho, Alberta, Montana and British Columbia due to mining (Brandborg 1955, Pendergast and Bindernagle 1975), logging and road access (Chadwick 1973, Joslin 1980, Phelps et al. 1975).

Mountain goats are native to the East Front of northern Montana's Rocky Mountains. The first investigations of this mountain goat population were conducted by Casebeer et al. in 1950. Aside from occasional aerial counts of goats by the Montana Department of Fish and Game, no other study of this population was conducted until 1979 when a graduate thesis (Thompson 1960) was prepared on this herd to provide an update to the early 1950's information. A brief follow-up to that endeavor was conducted by Tomasko (1980) and carried on by Joslin (1981).

Under the auspices of the Rocky Mountain Front Interagency Group, mountain goat monitoring work was continued in order to address potential impacts to mountain goats from energy exploration and other human activities. This report presents preliminary findings of mountain goat monitoring during 1981. This work was funded by the MDFWP and Forest Service under contract No. 53-0115-1-57. The goal of this project is to provide recommendations to both wildlife and land managers to minimize human disturbance upon mountain goats and their habitat. The following objectives are listed in order to meet this goal:

- delineation of mountain goat seasonal ranges
- determination of relative population levels and structure
- understanding of mountain goat behavior and population response when confronted with human disturbance.

This document reports findings to date and outlines areas of additional needed information. As such, it should be considered a progress report, and the conclusions and recommendations tentative.

STUDY AREA

The East Front mountain goat study area extends over approximately 600 square miles and is bounded on the south and west by the Sun River and Continental Divide, and on the north and east by Birch Creek and the Lewis and Clark National Forest boundary (Figure 1). The area lies approximately 25 miles west of Choteau, Montana. Major drainages within the study area include the Sun and Teton rivers, Blackleaf Creek (a tributary of the Teton) and tributaries of the Marias River including Dupuyer and Birch creeks. Relief varies from 4,400 feet at the Sun River to 9,392 feet atop Rocky Mountain. A complete description of land types and climate occurring within the study area as described by Holdorf (1981) is provided in Thompson (1980).

METHODS

Mountain goat monitoring along the East Front during 1981 included seasonal helicopter surveys, trapping and marking individual goats, locating radio-marked animals from the air and ground, food habits analysis and ground reconnaissance. Mountain goat surveys of the study area were completed with a Bell helicopter during March and July. All drainages within the study area were systematically inventoried. All goats were classified as follows: adult, subadult, kid, yearling, 2-year old, unclassified, unclassified nonkid (and male or female if possible). Ground observations were made with the aid of a 7x35 power binocular and a 15-60 variable power spotting scope.

Mountain goat observations were collected during aerial surveys, ground reconnaissance and aerial radio tracking. Locations of all observations were recorded according to quarter section, township and range. A list of data was collected from each observation and is presented in Appendix 1. The code sheet in Appendix 1 describes the data collected; however, certain items must be further described.

All sign and observations of mountain goats were recorded according to one of eight terrain types. The following four terms describe rocky terrain types: cliffs and cirque basins - rock faces several feet in height; bluffs - benches with rock drop-offs, often in step-like formation; talus - masses of shale or boulders, generally not capable of supporting vegetation to climax stage due to instability or poor edaphic features; broken - those areas which are not bluffs, cliffs or talus, but which were obviously difficult to traverse because of rocky substrates. If an area could not be defined by one of the rocky terrain types, then it was classified as one of the four remaining types, including: ridge - the line of land separating two drainages; creekbottom - bottom of a

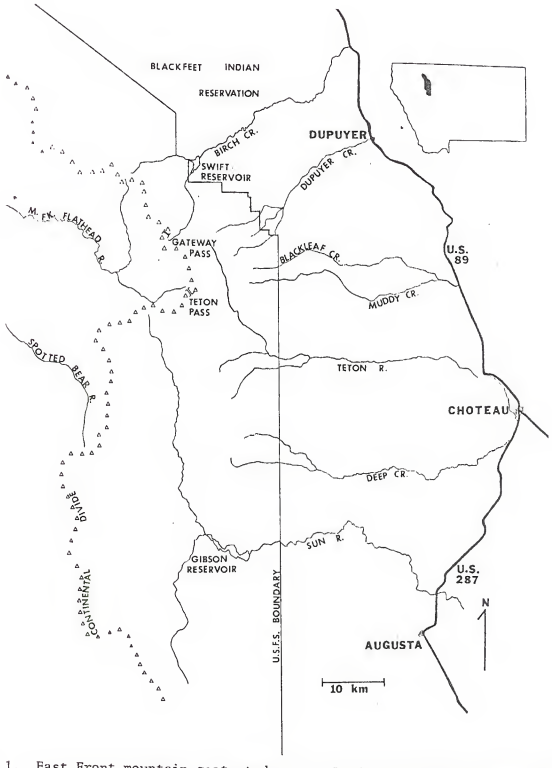

Figure 1. East Front mountain goat study area, Lewis and Clark National Forest.

drainage or line of land where opposing sidehills meet; park - a non-timbered flat or sloping area; sidehill - a catch-all term used to categorize any nonrocky area which would not fit any of the other terrain types. The talus and park type by definition were not timbered, but the six remaining terrain types could support any cover type.

Cliff, bluff and broken terrain types provided escape terrain which is defined as those areas providing maximum terrain security to goats. The cover type at the immediate site of an observation was assessed either quantitatively at sample sites of mountain goat use by pacing out a 1/10 acre circular plot or by making an ocular estimate from the air. Combinations of cover types were the norm. For example, a site having all four types would be recorded as timber or timber and shrub, depending on whether timber in itself was sufficient to conceal a goat. The grass/forb or rock/bare ground categories did not afford cover and were listed only if they composed at least 1/3 of the plot area. In lieu of habitat type, which was not readily available from forest maps, land type was derived from 1:24,000 topographic maps which have been delineated into land types on the basis of patterns of habitat type (Pfister et al. 1977, Mueggler and Handl 1978), landform and soil family occurrence according to Holdorf (1981). Elevation of observed goats was interpreted from 1:24,000 topographic maps or when flying, the estimated elevation was derived from the aircraft altimeter. Slope is not listed on the data form but slope of the terrain for each observation was obtained from a slope grid used on appropriate topographic maps.

The mountain goat capture and marking program was conducted using a 60x40 foot cannon net set up at the Blackleaf lick site. The net was hauled to the Blackleaf lick on June 23. Trapping efforts began on July 10 and terminated September 3. The lick was used regularly by goats from May through July. Although the trap was attended for 2 months, all goats were captured during 3 days in July. Captured mountain goats were fitted with either plastic PVC pipe collars containing an AVM radio transmitter and antennae or a 1-inch wide elastic expandable Wildlife Materials collar with transmitter and antennae attached; the former were placed on goats 2 years of age and older, while the expandable type were placed on yearlings. The frequency range was 150.700 through 151.900. All captured goats were marked with metal ear tags and the following information was taken: date of capture, tag number(s), transmitter frequency, collar color, sex, age, horn circumference and length, ear length, rostrum length, neck circumference, shoulder height, chest circumference and zoological length.

Telemetry tracking of radio-marked animals was generally accomplished from the air using a Piper Supercub fitted with a rotating belly-mounted three element Yagi antennae and a TR-2 Telonics receiver-scanner. Ground tracking was done using a Telonics two element hand-held Yagi antennae.

From March through September, efforts were made to observe foraging mountain goats in order to locate five feeding sites per month. After hiking to specific sites, a feeding site exam was conducted which consisted of laying out 15 2x5-decimeter frames at 2 meter intervals along the

approximate course which the feeding goat took, then recording the relative canopy coverage of all vegetation species occurring in the frames. Samples of all vegetation species encountered over the study period were collected for reference specimens to be used in the identification of vegetation found in mountain goat fecal samples. Plants were identified according to Hitchcock and Cronquist (1976). Five mountain goat pellet group samples were collected per month from March through September, and along with vegetation samples were sent to Montana State University for identification of vegetation in fecal samples through microhistological methods (Kasworm 1982).

RESULTS

Population Distribution and Abundance

During 1981, a population of at least 185 mountain goats occurred from the Sun River to the Badger-Two Medicine divide, west to the Continental Divide and North Fork Sun River. Although a total of 700 goats was observed on the study area from March through October, the greatest number counted was during March 1981 when all drainages within the study area were systematically surveyed from a helicopter. The Badger and Two Medicine areas were not inventoried at that time, however, making the estimate conservative. During July, even though these drainages were inventoried, the total number of goats observed was 50 less than during March. Classification data and location of all goats observed during March and July are presented in Tables 1 and 2, respectively. The unclassified component was 11.9 and 9.6 percent of the March and July survey, respectively. Keeping this in mind, the kid and subadult ratios must be interpreted cautiously. The kid per 100 nonkid ratio during March was 32.5 and during July was 25.7. The subadult per 100 adult ratio was 11.8 in March and 34.7 in July. The high March kid:nonkid ratio reflects good survival of the kid component, probably as a result of the mild 1980-81 winter. The high subadult to adult ratio during July reflects recruitment of the March kid component into the population. The relatively good July kid:nonkid ratio may also be a reflection of the previous mild winter.

The current population levels along the East Front are considerably lower than those reported by Casebeer et al. (1950) during the late 1940's. Casebeer et al. (1950) estimated over 200 goats in the Teton drainage alone, as compared to the intensive March 1981 survey when only 63 goats were observed in the same area.

Distribution maps given in Casebeer et al. (1950) reveal a significantly broader distribution of goats in the southern portion of the study area than that which currently exists. Their distribution figures along the exterior Front, however, from Choteau Mountain to Split Mountain are more restrictive than now. They also omit from their maps the area to the north and south of Mount Lockhart where goats were observed during this study. A refined distribution of mountain goats within the study area for the 1980's will be a product of current research.

Table 1. Location and classification of mountain goats observed during helicopter survey of East Front, March 11 and 12, 1981.

Drainage	S	T	R	Total	Adult	Sub-Adult	Kid	Uncl.
Mt. Poia	SE¼ 15	28	11	11	8	2	2	
Mt. Poia	NE¼ 22	28	11	4	2	1	1	
Family Pk	S½ 28	28	11	12	5	2	3	1
Mt Field	11	28	11	1	1			
Mt Richmond	31	28	10	6	4		2	
Mt Sentinel	5	27	10	6	4	1	1	
Lost Horse	SE¼ 14	27	10	3	2		1	
M Fk Birch	S½ 13	27	10	1	1			
Mt Drewyer	SW¼ 17	27	10	5	5			
Crooked Mtn	SE¼ 9	27	10	13	5	1	3	4
Mt Drewyer	20	27	10	3	2		1	
Pinto Cr	NW¼ 29	27	10	3	3			
Crazy Cr	NW¼ 3	26	10	2	1		1	
South Cr	SW¼ 31	27	9	2	2			
Hoy Gulch	32	27	9	1	1			
Walling Reef	NE¼ 7	27	9	2	2			
Walling Reef	17	27	9	2	1		1	
Ear Mtn	19	24	9	4	3		1	
N Fk Deep Cr	NE¼ 12	23	9	2	1		1	
Miners Basin	SW¼ 9	23	9	4	2	2		
Erosion Gulch	15	23	9	1	1			
Erosion Gulch	16	23	9	1	1			
No Business G	SW¼ 24	23	9	4	2		1	1
Castle Reef	12	22	9	1	1			
Miners Basin	W½ 5	23	9	2	2			
Miners Basin	S½ 29	24	9	7	4		2	1
Rocky Mtn	N½ 30	24	9	2	2			
Hdq Pass	N½ 19	24	9	15			4	*11
Ray Cr	SE¼ 14	24	10	1	1			
Old Baldy	NW¼ 7	24	9	10	5		2	3
Choteau Mtn	12	25	9	11	8	1	2	
Mt Werner	SW¼ 14	26	9	2	1		1	
Mt Frazier	NE¼ 15	26	9	4	2		1	1
Fright Cr	NW¼ 8	26	9	6	4	1	1	
Old Man/Hills	4	26	9	5	4		1	
Old Man/Hills	33	27	9	5	3	1	1	
Bruce Cr	S½ 13	26	9	6	4		2	
Bruce Cr	N½ 15	26	10	2	2			
Bruce Cr	N½ 15	26	10	1	1			
Jones Cr	4	25	9	7	3	1	3	
Mt Wright	SW¼ 36	26	10	1	1			
Mt Lockhart	N½ 12	25	10	2	1		1	
N Fk Teton	30	25	9	2	2			

Table 2. Location and classification of mountain goats observed during helicopter survey of East Front, July 11, 12 and 18, 1981.

Drainage	Location S		T(N)	R(W)	Total	Adult	Sub-Adult	Kid	Uncl.
Family Pk	SE¼	28	28	11	3	1	1	1	
Mt Field	SE¼	2	27	11	1				1
Mt Field	NE¼	11	27	11	2	1	1		
Mt Drewyer	SW¼	21	27	11	5	2	2		1
Pat Gass	SW¼	3	26	10	1				1
Bum Shot	NE¼	26	27	10	1	1			
Walling Reef	SW¼	16	27	9	2				2
Walling Reef	NW¼	17	27	9	1	1			
Walling Reef	SE¼	20	27	9	6	2	1	1	2
Walling Reef	SE¼	20	27	9	5	2		1	2
N Fk Dupuyer	SW¼	36	27	10	2				2
Old Man/Hills	SE¼	33	27	9	3	1	1		1
S Fk Dupuyer	SE¼	8	26	9	6	2	2	2	
S Fk Dupuyer	SE¼	8	26	9	2	1		1	
S Fk Dupuyer	SW¼	8	26	9	7	2	3	1	1
Mt Werner	NE¼	22	26	9	2	1	1		
Choteau Mt	NE¼	35	26	9	2	1	1		
Choteau Mt	NE¼	35	26	9	1	1			
Choteau Mt	NE¼	13	25	9	9	4	3	2	
Pat Gass	NE¼	10	26	10	1	1			
S Fk Nanny	SW¼	10	26	10	1	1			
S Fk Nanny	NW¼	14	26	10	2	1	1		
Mt Wright	NE¼	27	26	10	2	2			
Mt Wright	NE¼	27	26	10	3	3			
Mt Wright	NE¼	27	26	10	2	2			
Mt Wright	SW¼	27	26	10	1	1			
Mt Lockhart		11	25	10	7	5		2	
Waldron Cr	SW¼	14	25	10	4	3		1	
Cave Mtn	SE¼	22	25	9	2	1		1	
Cave Mtn	SE¼	22	25	9	1		1		
Rocky Mtn	SW¼	20	24	9	4	2		2	
Ear Mtn		13	24	9	1	1			
Limestone Cr	SW¼	15	28	11	1	1			
Scar Face	NE¼	21	28	11	4	1	2	1	
Scar Face	NE¼	16	28	11	2	1	1		
Morning Star		9	28	11	2	1	1		
Scar Face	SW¼	15	28	11	1	1			
Spotted Eagle		7	28	11	3	2		1	
Spotted Eagle		18	28	11	4	2		2	
Spotted Eagle		18	28	11	6	3	1	2	
Spotted Eagle		18	28	11	1	1			
Curly Bear		7	28	11	3	1	1	1	
Badger Cr	N½	5	28	12	3	1	1	1	
Slim Gulch	N½	35	24	9	2	1		1	
S Fk Teton	E½	28	24	9	2	2			
S Fk Teton		18	24	9	9	8		1	

Distribution of mountain goats within the East Front study area favors the central and northern portions, as illustrated in Figure 2. Although the land area which is drained by Deep Creek and Sun River accounts for roughly the southern 30 percent of the study area, less than 16 and 2 percent of the goats observed during aerial surveys were noted in these drainages. The Badger Creek and Two Medicine River drainages were not surveyed during March 1981, but 93 goats were observed in the two most northerly drainages which were inventoried (Dupuyer and Birch creeks). In comparison, 90 goats were observed in the Dupuyer, Birch and Badger drainages during July 1981. Goats were not observed in the Two Medicine drainage during the July survey.

Although poor flying conditions exist during winter, aerial surveys at this time appear to provide the most accurate census information. Tracks in the snow often lead observers to goats which would not otherwise be observed. Summer surveys may be less efficient in counting goats, since goats tend to seek timber or shrub cover to escape the heat.

Seasonal Use Areas

Overall Mountain Goat Range

Overall mountain goat range includes all seasonal use areas, as well as the land area in between. As such, overall mountain goat range along the northern portion of the East Front is synonymous with the described study area. Within overall mountain goat range, mountain goats may be expected to occur at any given location at some time during the year. Six seasonal use areas should be described and mapped if mountain goat habitats and needs are to be properly managed. These seasonal use areas include winter range, kidding areas, breeding areas, summer range, nursery areas and mineral licks.

Throughout the following discussion, the term "key" is used to emphasize those portions of mountain goat range on which goats concentrate at some time during the year. The kidding and breeding areas are key use areas which generally occur within winter range, while the nursery areas and mineral licks are key use areas which occur within summer range. Seasonal use areas have been delineated to the extent that they are known. Winter range, nursery areas and mineral licks have been tentatively identified from ground reconnaissance, helicopter surveys and tracking of 12 radio-marked goats.

Winter Range

Winter ranges on the East Front study area were defined on the basis of the March 1981 helicopter survey and radio locations of collared individuals. Aerial photo and topographic map interpretation will be necessary to more distinctly define known key winter range and identify probable winter range. Currently, 20 ranges are known to support wintering goats. Areas delineated in Figures 3-13 are based on observations of 159 goats, on relocations of 2 radio-marked goats and on aspect and slope criteria.

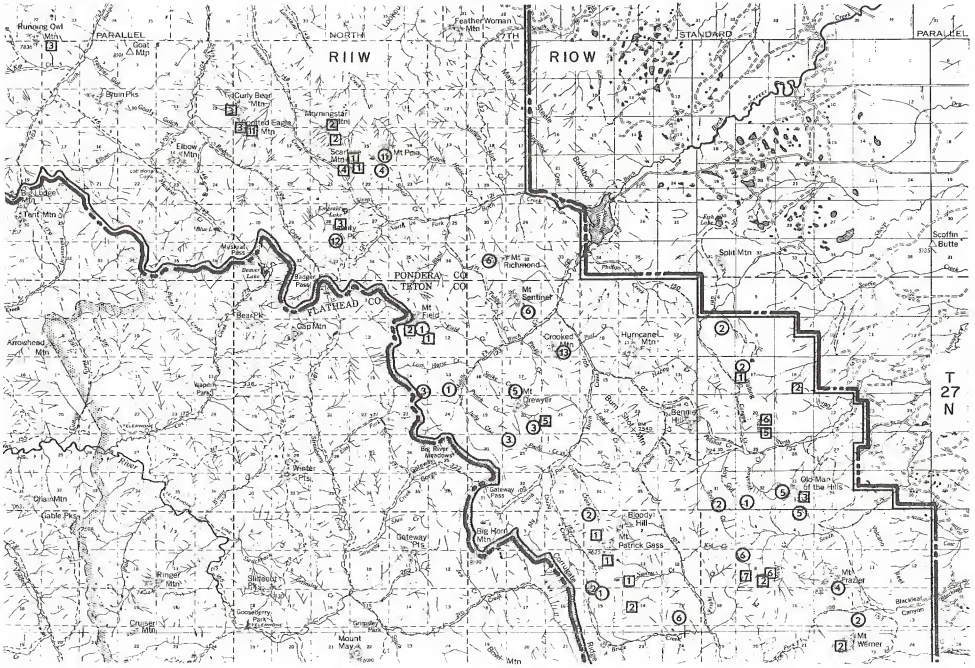

Figure 2. Locations of mountain goats observed within the East Front study area during the March (circles) and July (squares) 1981, helicopter surveys.

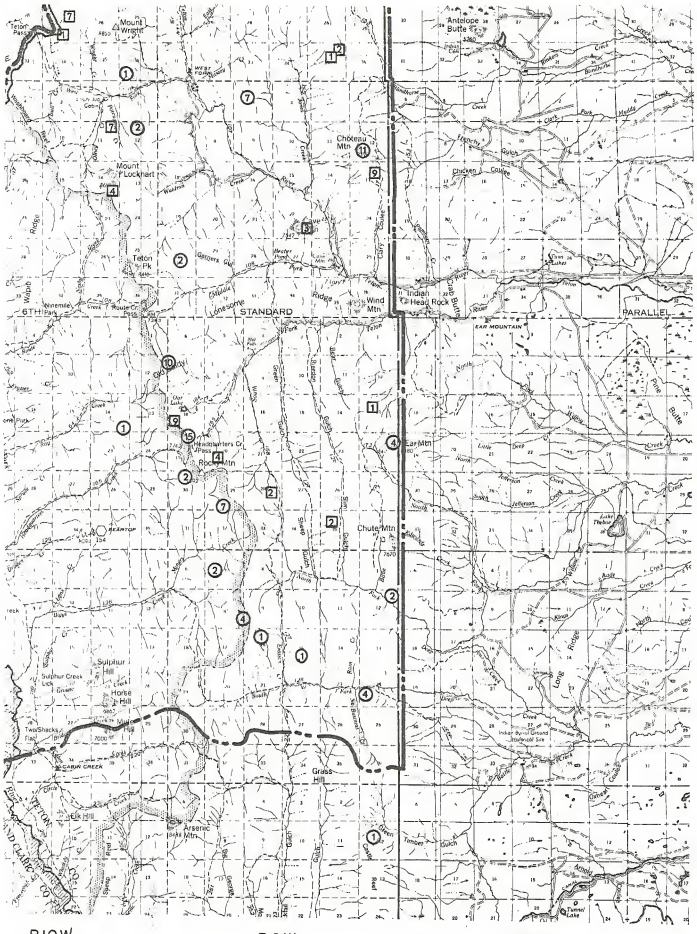

Figure 2, continued.

Figure 3. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

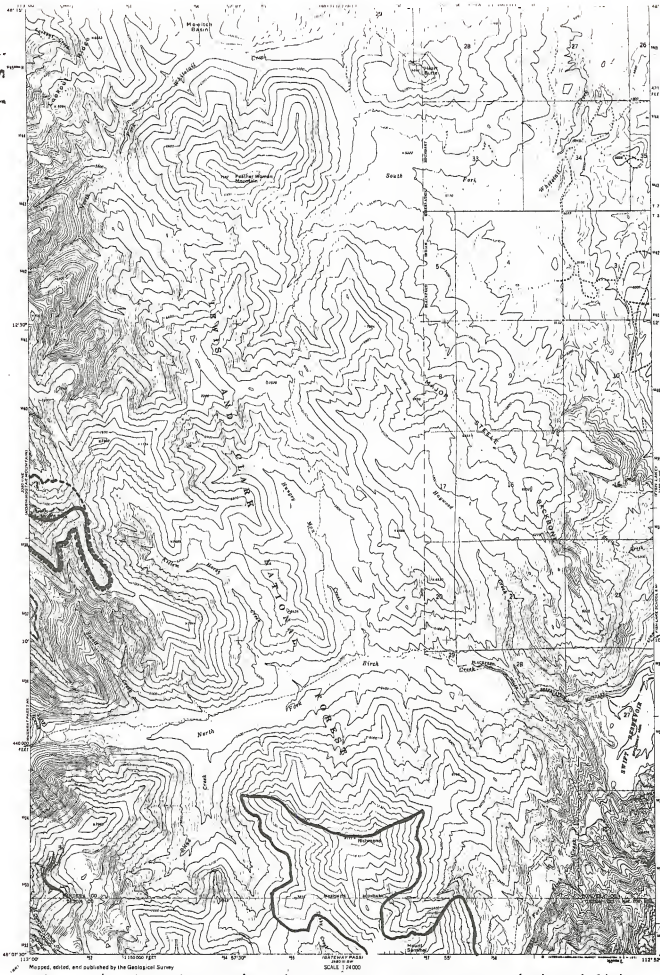

Figure 4. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

Figure 5. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

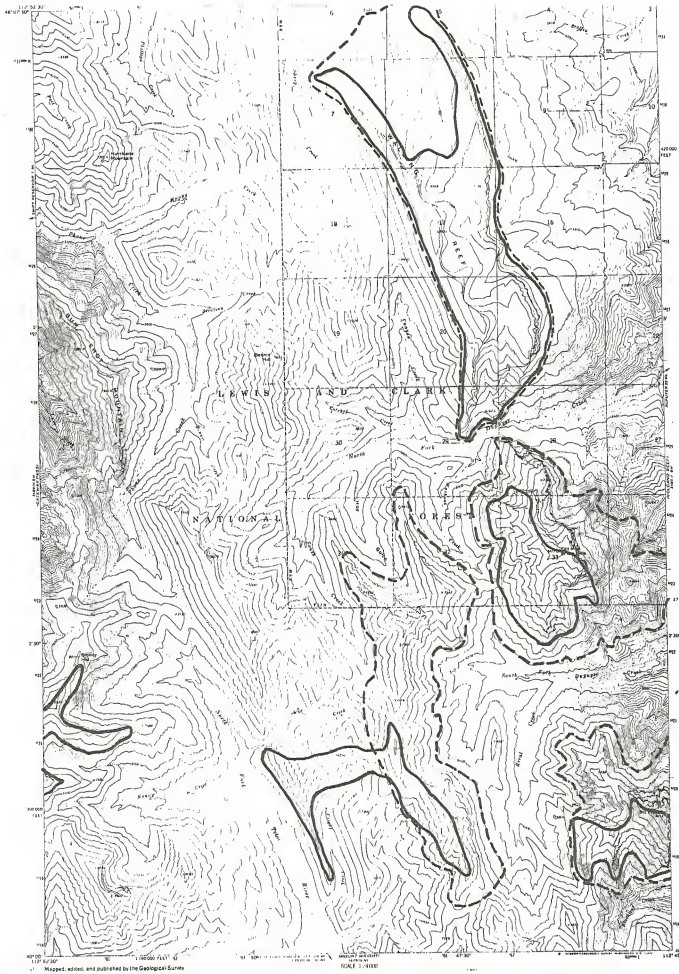

Figure 6 . Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

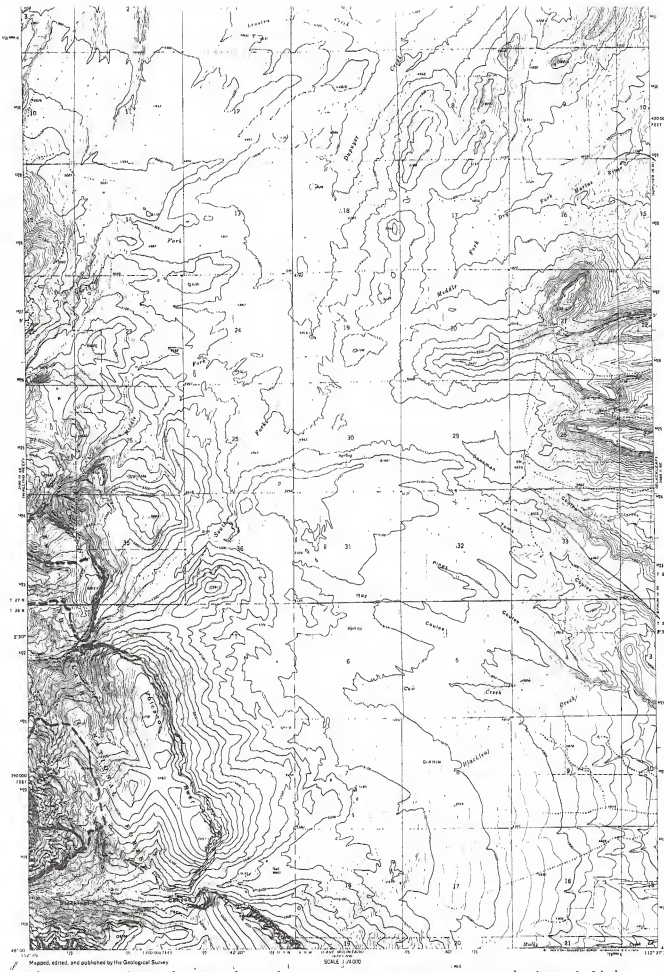

Figure 7. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

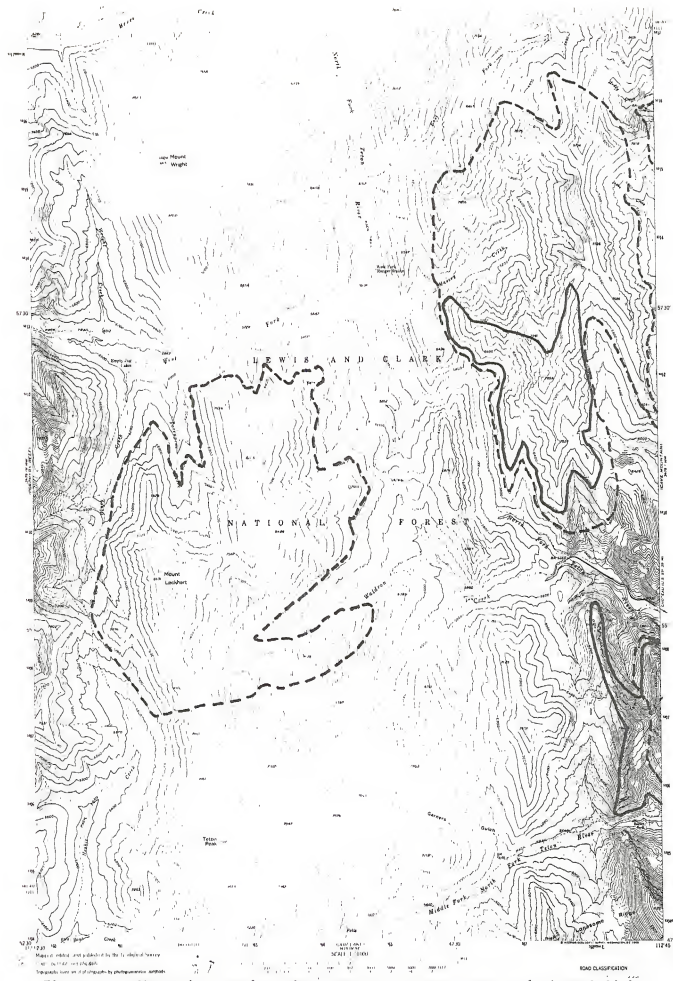

Figure 8. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

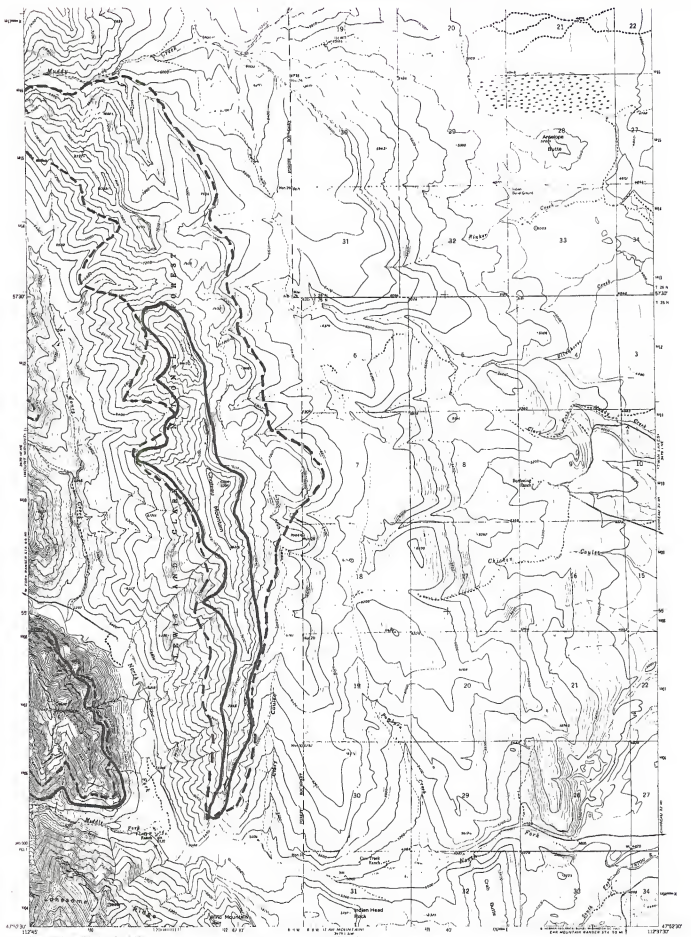

Figure 9. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

Figure 10. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

LEWIS AND CLARK NATIONAL FOREST
Ear Mountain
Chute Mountain
Chute Mountain
Creek
Creek
Creek

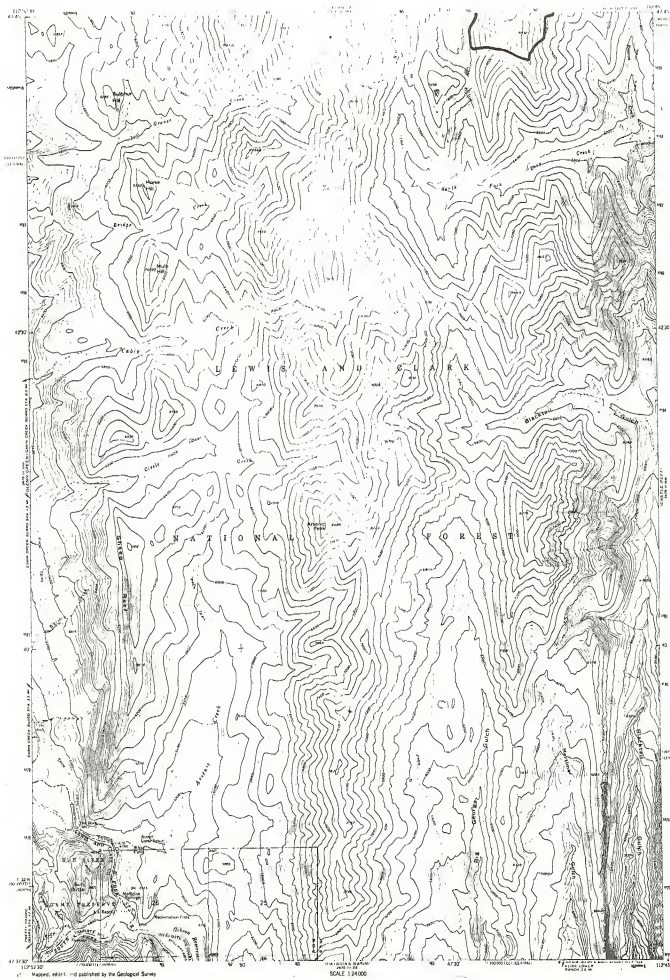

Figure 12. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

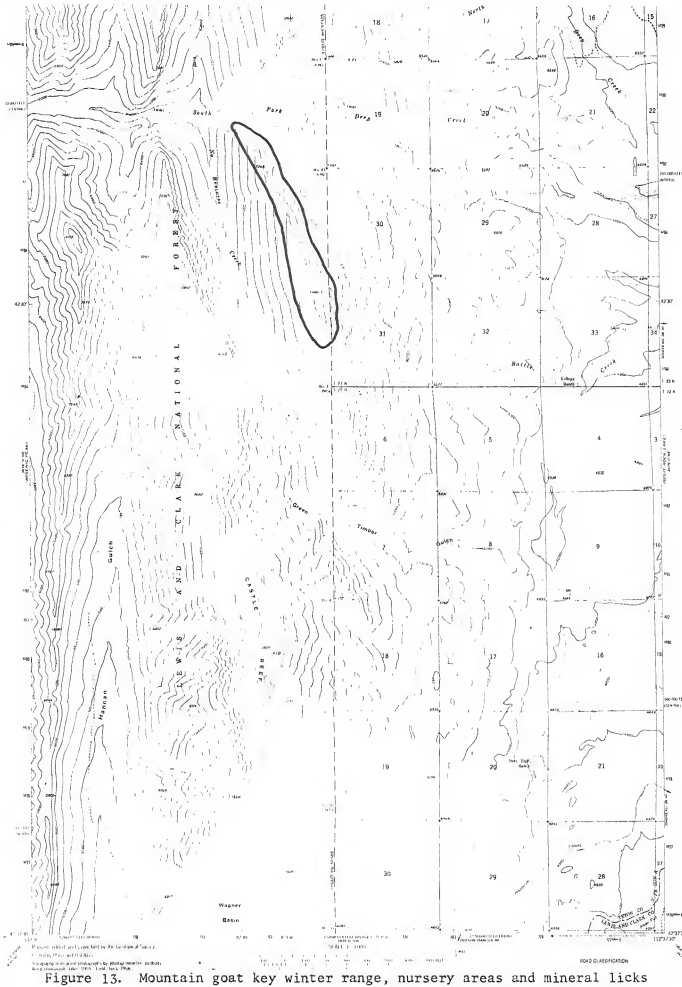

Figure 13. Mountain goat key winter range, nursery areas and mineral licks occurring on the East Front, Lewis & Clark National Forest 1981.

Although 185 goats were observed during the March survey, only those animals which appeared to be using a defined area were used to outline key winter range. The average group size of wintering goats was 8.8. Nine groups were comprised of 4-7 goats, while nine groups were comprised of 10-15 goats. The remaining 26 goats which are not accounted for were observed along ridges in groups of 1 or 2. These goats were thought to be moving between areas, which would have been possible during the mild winter of 1980-81. Within each of the major drainages of the study area, the following numbers of key winter ranges are known to occur: Birch Creek 6, Dupuyer Creek 3, Teton River 8, Deep Creek 2, Sun River 1. The average group size for each of these areas is 10.5, 9.0, 9.0, 4.0 and 7.0, respectively. The Old Baldy, Rocky Mountain, Miners Basin and Deep Creek ranges were identified on the basis of individual wintering groups, although in Figures 9 and 11 they were fused together to form one large wintering complex. The Mount Richmond and Mount Sentinel ranges were also fused together (Figures 3 and 4). This information reveals that not only are the greatest number of winter ranges in the north portion of the study area, but also that these areas support the majority of wintering goats. This is not to say that the southern portion of the study area is not good goat habitat, however. The fact that prior to the 1970's, the area south of the Teton River received significant hunting and trapping pressure contributed to the overall population decline of the Continental Divide mountain goat herd. In 1948, Brandborg (1950) counted 110 goats in the South Fork Teton and Deep Creek drainages, which is significantly more than were observed during this study. Trapping from the Deep Creek herd has not occurred since 1970, and this area has been closed to mountain goat hunting for several years, so continued monitoring of the southern portion of the study area will indicate whether this herd is recuperating.

Kidding Areas

Kidding areas will be particularly difficult to locate, because groups of goats dissipate during the parturition period as females seek solitude in remote, extremely rugged portions of their home range. Females remain at or near the birth site from 1-2 weeks after the young are born. Smith (1976) indicates that kidding takes place on winter range, although a given female may not necessarily use her winter range for kidding - she may move to a different area specifically to give birth. Chadwick (1973) felt that certain areas were traditionally used during kidding. Since parturition occurs during approximately a 4-week period from mid-May to mid-June, and because females adopt a solitary existence in particularly rugged terrain, it may require several years to identify most kidding areas. It is predicted that several will be found on the steep, broken, north faces of the major peaks within the study area.

Breeding Areas

It has not been determined whether specific breeding areas exist, but if they do, helicopter surveys conducted during the November-December rutting period should identify them. Goats tend to form large groups

during the breeding period (Brandborg 1950) and since males are attending females, sex ratios are best determined at this time of year. Unfortunately, high winds and inclement weather are the norm during November and December, making surveys difficult.

Summer Range

All primary ridges within the study area are considered to be key summer-transitional range, because portions of them are not only used for daily activities, but the system of ridges as a whole provides major travel corridors between seasonal ranges. Because of their ubiquitous distribution and dendritic pattern, ridges are not outlined on the attached figures, but they are summer range and they should be managed accordingly. All nursery areas constitute key summer range, and those which have been identified are delineated.

Nursery Areas

Nursery areas are defined as those portions of overall goat range which were used from June through October by groups of goats containing at least one young-of-the-year. Thirteen nursery areas identified through aerial surveys and ground reconnaissance are shown in Figures 3-13. Of the 13 known nursery areas, 3, 4, 5 and 1 occurred in the Birch, Dupuyer, Teton and Deep Creek drainages, respectively.

Past distribution of nursery areas indicates that the southern portion of the study area contains important nursery habitat, even though only one nursery area has been identified during the present study. Brandborg (1950), during a June-July 1948 survey, counted 87 goats quite evenly distributed over the area from the Sun River north to the South Fork Teton, and east of the Deep Creek-Sun River divide. Brandborg (1950) and Martin (1969) observed nursery groups in the area between North Fork Deep Creek and South Fork Teton, but in 1979 Thompson (1980) did not make similar observations. In the southern portion of the study area, during the present study, only a single nanny and kid were observed in the North Fork Deep Creek during July. Another nanny and kid were observed in the southern portion of the study area at the junction of Billie Creek and the North Fork Deep Creek. The area was not considered a nursery area because the observation was made during March.

Mineral Licks

Eight known mineral licks occur on the study area, and are identified in Figures 6, 7, 9, 10 and 11. They include North Fork Deep Creek, Headquarters Pass, Our Lake, Frenchy Gulch, Blindhorse Gulch, Blackleaf Creek, South Fork Dupuyer and Walling Reef. During this study, goat use was observed at the Blackleaf and South Fork Dupuyer lick sites. Although observations were not made at the remaining six sites, all are known to be used by goats (Thompson 1980 and pers. com., McCarthy pers. comm., McLucas pers. comm.). Capture data during this study and Thompson's (1980) study, as well as information from numerous researchers (Hebert 1967, McCrory 1965, DeBock 1970), indicate that adult males are likely to use licks during spring and early summer while females and young frequent licks during summer after parturition.

Other mineral licks undoubtedly occur on the study area, particularly in the less observable interior portions of the area, but additional reconnaissance will be needed to locate them.

Physical Characteristics

Measurements of six goats captured during July are presented in Table 3. Casebeer et al. (1950) cites the average kidding period to be between May 15 and June 6. Based on an average date of June 1, the ages listed in Table 3 are minimums and may be 1 month younger than the actual age. Comparison of measurements from each age group with measurements taken from Montana mountain goats by Brandborg (1950) are very similar. Horn lengths and circumference of 13 to 14 month old goats measured during this study were slightly larger than similar measurements from 12 month old goats taken by Brandborg (1950). Comparison of the four yearlings captured during this study show that measurements of the male were nearly always larger than those of the three females. In body size, the 3-year old female was consistently larger than the 2-year old male; however, comparison of horn circumference and length shows the male's horns to be slightly larger. Neck circumference is not comparable, since the six animals were at various stages of molt.

Individual Movements

In addition to the six goats which were captured during 1981, six other goats which had been marked from the previous 2 years were also followed. A total of 165 radio locations was collected during 1981 on these 12 marked individuals. During 1980, 52 relocations of the first six goats were obtained by Tomasko and Olson (Tomasko 1980). These data were recorded along with those obtained during 1981 in Tables 4-15. These tables correspond to Figures 14-25, which depict each relocation chronologically. A discussion of each goat's movements, with information provided for 1979 and early 1980 provided by Thompson (1980), follows:

Female mountain goat number 52 was captured June 27, 1979 as a 3-year old. She used the Blackleaf lick during June and/or July during each of 3 years. Her home range occurred along the line of peaks from Mount Frazier to Werner Peak south along Choteau Mountain (Table 4 and Figure 14). Summer use tended to be concentrated along the north end of Choteau Mountain, while winter use occurred along the ridgeline and the southern end of the mountain. The 1981 kidding period was spent on the east face of the rugged peaks north of Choteau Mountain. The breeding period was spent in the same area.

Male mountain goat number 85 was captured July 14, 1979 as a 3-year old. His movements seem to have shifted from 1979 when he used the Muddy Creek, Jones Creek and Choteau Mountain areas, to 1980 when he appeared to be making a transition northward. By 1981 his center of activity was around Walling Reef and west to Bruce Creek (Table 7 and Figure 17). He used the Blackleaf lick during July of all 3 years. Rutting period movements during 1979 and 1980 were in the Muddy and Jones Creek drainages and along the east face of Choteau Mountain. A single November 1981 location was on Walling Reef.

Table 3. Information collected from six mountain goats captured at the Blackleaf lick site during July, 1981.

Date captured	7/10	7/20	7/20	7/27	7/27	7/27
Ear Tag Right		A 10573	A 6264			A 10553
Ear Tag Left			A 6265	A 10554	A 10574	
Collar Color	White Expandable	Black Expandable	Red Expandable	Green Expandable	Red & Yellow PVC Pipe	Red & Yellow PVC Pipe
Sex	Female	Female	Male	Female	Male	Female
Age	13 Months	13 Months	13 Months	13 Months	25 Months	37 Months
Horn Circumference 1/						
Right	3.00	3.25	3.50	2.75	4.125	4.00
Left	3.00	3.00	3.00	2.75	4.125	3.75
Horn Length						
Right	4.00	5.00	5.50	4.00	8.00	8.00
Left	4.00	4.75	5.00	4.00	8.00	7.75
Ear Length	4.00	4.25	4.25	4.00	4.25	5.00
Rostrum Length		6.75	7.00	6.75	7.625	9.75
Neck Circumference	12.00	10.50	12.50	9.25	14.00	13.00
Shoulder Height	25.00	26.00	27.00	24.00	28.00	32.75
Chest Circumference	28.00			26.50	34.50	38.00
Zoological Length	35.00	39.00	40.00	37.00	38.00	47.00

1/ All measurements are in inches.

Table 4. Relocations of five-year-old female mountain goat, no. 52

Relocation No.	Date	Drainage	Location S	T	R
1	7/10/80	Muddy Creek	27	26	9
2	7/31/80	Mt Frazier	10	26	9
3	8/30/80	S Fk Dupuyer	10	26	9
4	9/13/80	Blackleaf Cr	15	26	9
5	9/26/80	N Fk Teton	17	26	9
6	3/24/81	Choteau Mtn	13	25	9
7	3/25/81	Choteau Mtn/Clary Coulee	24	25	9
8	3/27/81	Choteau Mtn	24	25	9
9	5/ 3/81	Muddy Cr	26	26	9
10	6/11/81	N Fk Blindhorse	35	26	9
11	6/18/81	N Fk Blindhorse	35	26	9
12	7/ 5/81	N Fk Blindhorse	36	26	9
13	7/10/81	Choteau Mtn	12	25	9
14	7/23/81	Mt Frazier	SE 10	26	9
15	7/23/81	Mt Frazier	SE 10	26	9
16	8/ 5/81	Square Top	26	26	9
17	8/19/81	Muddy Cr	26	26	9
18	9/ 8/81	Muddy Cr	26	26	9
19	9/27/81	Muddy Cr	26	26	9
20	10/10/81	Mt Werner	SE 22	26	9
21	10/22/81	Blindhorse	36	26	9
22	11/13/81	Jones Cr	SW 26	26	9

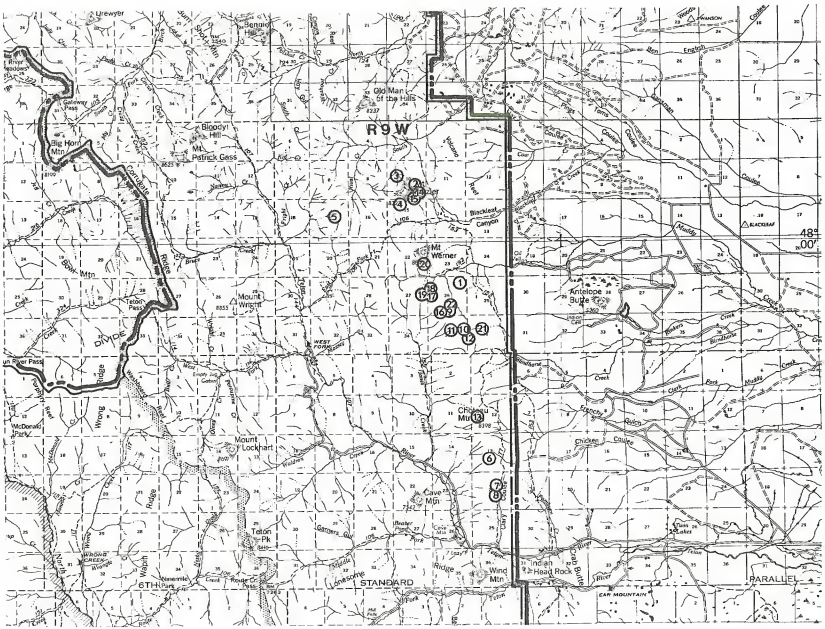

Figure 14. Relocations of five-year-old female mountain goat, no. 52.

Table 5. Relocations of six-year-old female mountain goat, no. 82.

Relocation No.	Date	Drainage	Location S	T	R
1	7/10/80	Blackleaf Lick	10	26	9
2	7/31/80	Blackleaf Cr	15	26	9
3	8/30/80	Blackleaf Cr	15	26	9
4	9/26/80	Rival Cr	17	26	9
5	10/3 /80	S Fk Dupuyer Cr	8	26	9
6	10/28/80	E Fk/N Fk Teton	28	26	9
7	11/12/80	Rival Cr	16	26	9
8	11/24/80	Rival Cr	16	26	9
9	1/ 3/81	Mt Frazier	10	26	9
10	2/28/81	Massey Cr	NW 33	26	9
11	3/27/81	Choteau/N Fk Teton	25	25	9
12	5/ 3/81	N Fk Teton	19	26	9
13	5/24/81	N Fk Teton	19	26	9
14	6/11/81	N Fk Teton	19	26	9
15	6/19/81	Mt Frazier	10	26	9
16	7/10/81	Blackleaf Lick	11	26	9
17	7/23/81	Mt Frazier	SE 10	26	9
18	8/ 4/81	South Cr	6	26	9
19	8/19/81	Blackleaf Cr	SE 16	26	9
20	9/ 2/81	Massey Cr			
21	9/ 8/81	Massey Cr/Jones Cr	4	25	9
22	10/10/81	N Fk Teton	NE 19	26	9
23	10/22/81	Fright Cr	18	26	9
24	11/13/81	Fright Cr	NW 18	26	9

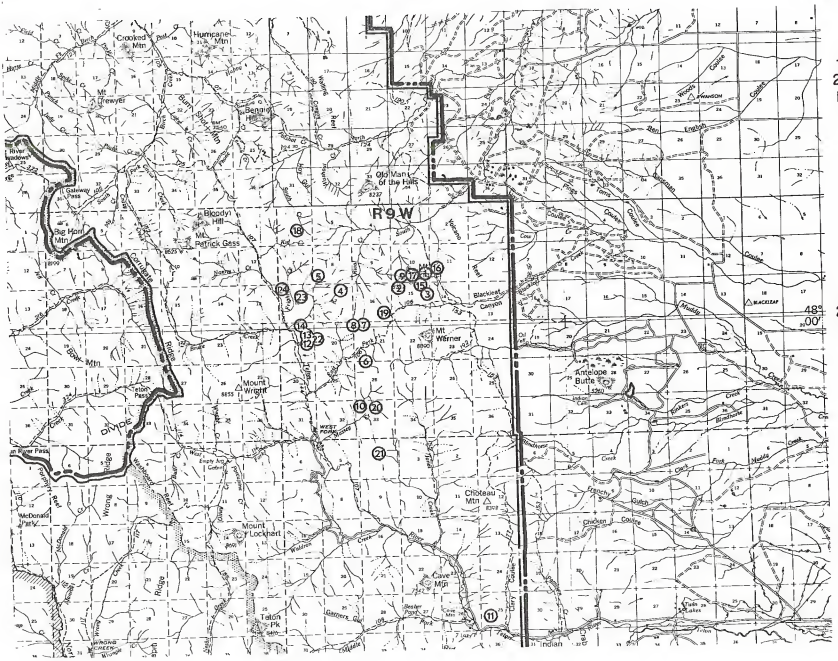

Figure 15. Relocations of six-year-old female mountain goat, no. 82.

Table 6. Relocations of six-year-old female mountain goat, No. 72.

Relocation No.	Date	Drainage	Location S	T	R
1	7/10/80	S Fk Dupuyer	10	26	9
2	7/31/80	Blackleaf Lick	11	26	9
3	8/30/80	Blackleaf Cr	15	26	9
4	9/13/80	Blackleaf Cr	15	26	9
5	9/26/80	N Fk Teton	17	26	9
6	10/ 3/80	N Fk Teton	17	26	9
7	10/28/80	Rival Cr	9	26	9
8	11/12/80	E Fk/N Fk Teton	28	26	9
9	11/24/80	Muddy Cr	21	26	9
10	1/ 3/81	Mt Frazier	10	26	9
11	2/28/81	Nanny Cr	SE 1	26	10
12	3/10/81	Blackleaf Cr/Mt Frazier	NW 15	26	9
13	3/27/81	S Fk Dupuyer	5	26	9
14	5/ 3/81	N Fk Teton	19	26	9
15	6/11/81	Mt Frazier	10	26	9
16	6/19/81	Mt Frazier	10	26	9
17	7/10/81	Mt Frazier	10	26	9
18	7/20/81	Mt Frazier	SE 10	26	9
19	7/23/81	Mt Frazier	SE 10	26	9
20	8/ 5/81	Rival Cr	16	26	9
21	8/19/81	Blackleaf Cr	SE 16	26	9
22	9/ 2/81	Massey Cr			
23	9/ 8/81	Blackleaf	16	26	9
24	9/27/81	S Fk Dupuyer	5	26	9
25	10/10/81	N Fk Teton	NE 19	26	9
26	10/22/81	Mt Frazier	SE 10	26	9
27	11/13/81	Rival Cr	17	26	9

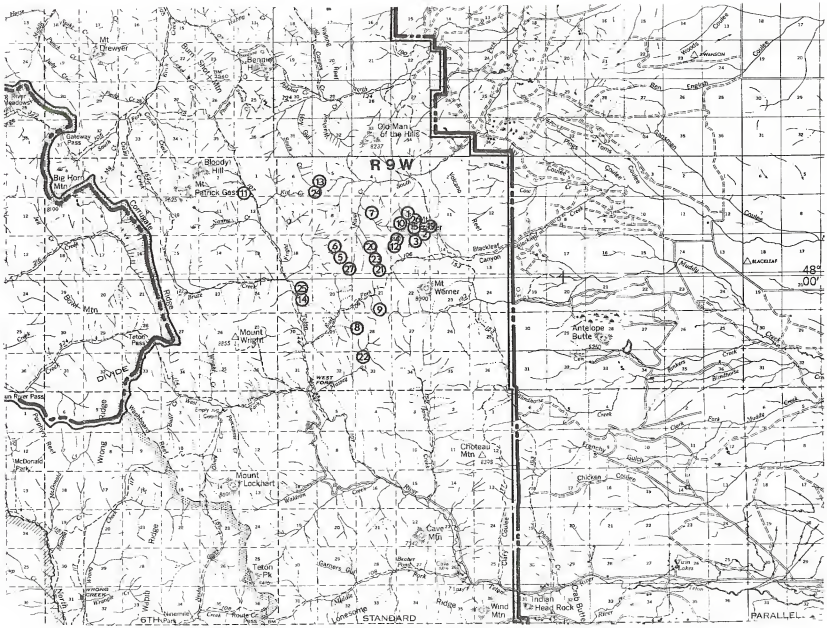

Figure 16. Relocations of six-year-old female mountain goat, no. 72.

Table 7. Relocations of five-year-old male mountain goat, No.85.

Relocation No.	Date	Drainage	Location S	T	R
1	7/ 3/80	Mt Frazier	11	26	9
2	7/10/80	Blackleaf Cr	15	26	9
3	7/31/80	N Fk Dupuyer	16	27	9
4	8/30/80	Massey Cr	33	26	9
5	9/26/80	N Fk Teton	17	26	9
6	10/ 3/80	N Fk Teton	8	26	9
7	10/28/80	Walling Reef	20	27	9
8	11/ 9/80	Choteau Mtn	12	25	9
9	11/11/80	Choteau Mtn	12	25	9
10	11/24/80	Choteau Mtn	20	25	9
11	1/ 3/81	Old Man of the Hills	33	27	9
12	2/28/81	Walling Reef	NW 20	27	9
13	3/10/81	N Fk Dupuyer	SW 21	27	9
14	3/27/81	Walling Reef	21-28	27	9
15	5/ 3/81	Walling Reef	SW 21	27	9
16	5/24/81	Bum Shot Mtn	22	27	10
17	6/11/81	Bruce Cr	13	26	10
18	7/10/81	Mt Frazier	10	26	9
19	7/23/81	Walling Reef	NE 20	27	9
20	8/ 4/81	Old Man of the Hills	33	27	9
21	8/19/81	Walling Reef	W 21	27	9
22	8/22/81	Walling Reef	E 20	27	9
23	9/ 8/81	Walling Reef	E 20	27	9
24	9/27/81	N Fk Teton	20	26	9
25	10/10/81	Bruce Cr	NE 22	26	10
26	10/22/81	S Fk Nanny Cr	NE 14	26	10
27	11/13/81	Walling Reef	SE 20	27	9

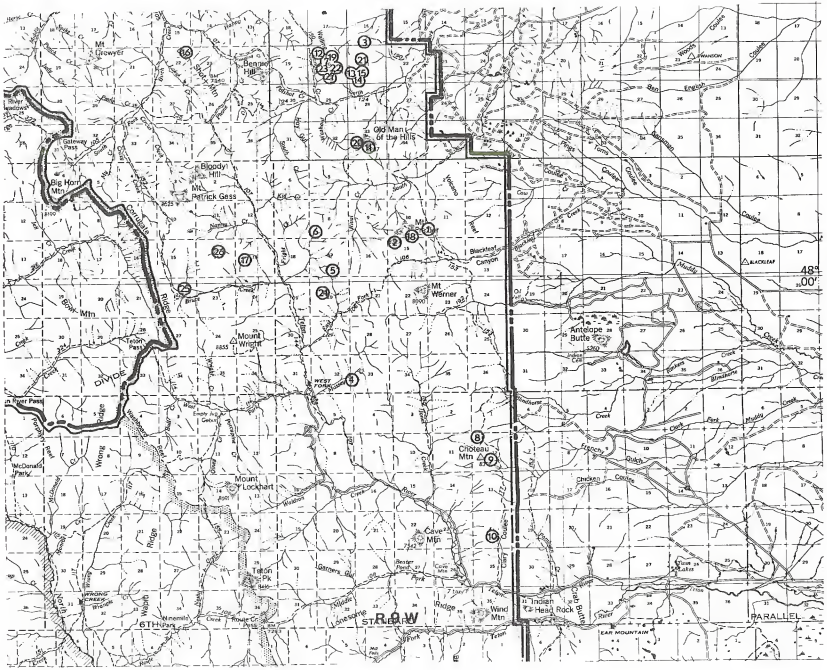

Figure 17. Relocations of five-year-old male mountain goat, no. 85.

Table 8. Relocations of ten-year-old male mountain goat, No. 23

Relocation No.	Date	Drainage	Location S	T	R
1	7/10/80	S Fk Dupuyer	10	26	9
2	7/31/80	S Fk Dupuyer	10	26	9
3	8/30/80	Mt Frazier	10	26	9
4	9/26/80	Cave Mtn/N Fk Teton	21	25	9
5	10/ 3/80	N Fk Teton	21	25	9
6	11/12/80	Blackleaf Cr	8	26	9
7	11/24/80	Rival Cr	16	26	9
8	1/ 3/81	Mt Frazier	10	26	9
9	2/28/81	Jones Cr	NE 15	25	9
10	3/10/81	N Fk Teton/Cave Mtn	NW,SW23	25	9
11	3/24/81	N Fk Teton/Cave Mtn	NW,SW23	25	9
12	3/27/81	N Fk Teton/Cave Mtn	NW,SW23	25	9
13	4/10/81	N Fk Teton/Cave Mtn	NW 26	25	9
14	5/ 3/81	S Fk Teton/Mill Falls	NE,SW 4	24	9
15	5/24/81	S Fk Teton	34	25	9
16	6/11/81	Cave Mtn	22	25	9
17	6/19/81	Cave Mtn	NE,SE22	25	9
18	7/10/81	Blackleaf Lick	11	26	9
19	7/23/81	S Fk Dupuyer/Mt Frazier	SW 10	26	9
20	8/ 4/81	Mt Frazier	10	26	9
21	8/19/81	Rival Cr	SE 16	26	9
22	9/ 2/81	Cave Mtn	NE 22	25	9
23	9/ 8/81	Cave Mtn	22	25	9
24	9/27/81	N Fk Teton	33	26	9
25	10/10/81	Cave Mtn	22	25	9
26	10/22/81	Cave Mtn	SE 22	25	9

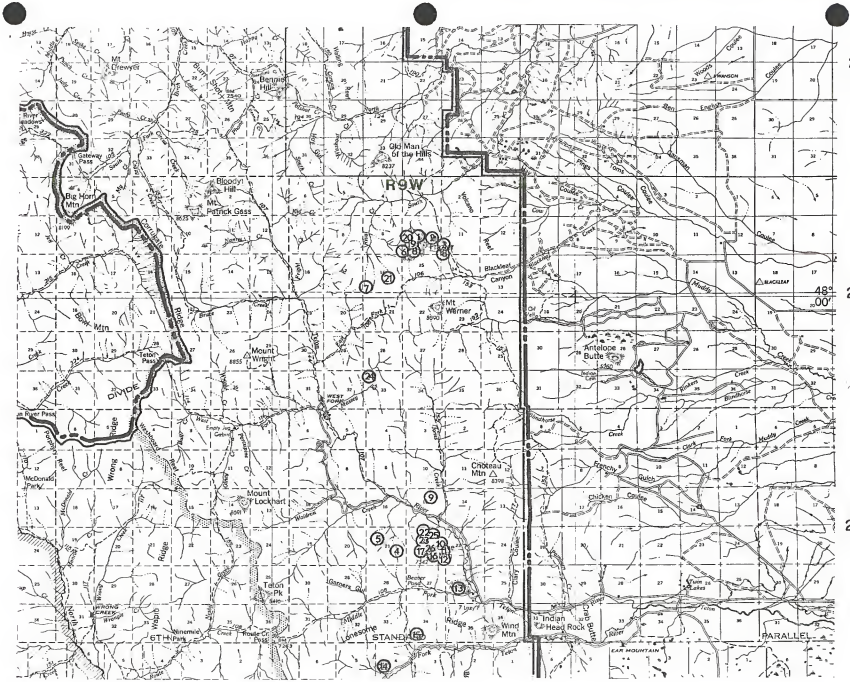

Figure 18. Relocations of ten-year-old male mountain goat, no. 23.

Table 9. Relocations of five-year-old female mountain goat, No. 22.

Relocation No.	Date	Drainage	Location S	T	R
1	7/24/80	S Fk Teton	18	24	9
2	7/29/80	S Fk Teton	18	24	9
3	7/31/80	S Fk Teton	7	24	9
4	8/30/80	S Fk Teton	7	24	9
5	9/ 9/80	Biggs Cr	19	24	9
6	9/10/80	Biggs Cr	18	24	9
7	9/26/80	Biggs Cr	18	24	9
8	10/ 3/80	Biggs Cr	19	24	9
9	10/28/80	Biggs Cr	19	24	9
10	11/ 3/80	Biggs Cr	19	24	9
11	11/12/80	Biggs Cr	20	24	9
12	11/24/80	Biggs Cr	20	24	9
13	1/ 3/81	Miners Cr	SW 33	24	9
14	2/28/81	Miners Cr	NW 33	24	9
15	3/10/81	Miners Basin/Rocky Mtn	NW,NW33	24	9
16	3/27/81	Miners Basin/Rocky Mtn	31	24	9
17	5/ 3/81	Billie Cr	NW 1	23	9
18	5/24/81	Billie Cr	NW 36	24	9
19	6/11/81	Miners Basin	29	24	9
20	7/10/81	Headquarters Pass	NW 20	24	9
21	7/23/81	Rocky Mtn	NW 20	24	9
22	8/ 5/81	Rocky Mtn	NW 20	24	9
23	8/19/81	Headquarters Pass	19	24	9
24	9/ 8/81	Rocky Mtn	SW 20	24	9
25	10/10/81	Headquarters Pass	NE 20	24	9
26	10/22/81	N Fk Deep Cr	33	24	9
27	11/13/81	Rocky Mtn	NE 30	24	9

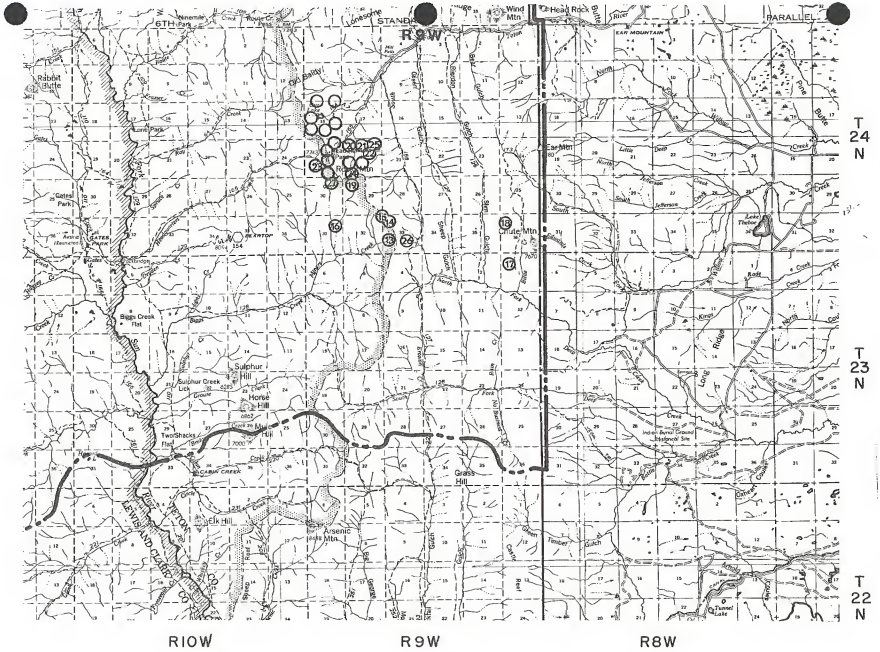

Figure 19. Relocations of five-year-old female mountain goat, no. 22.

Table 10. Relocations of yearling female mountain goat, No. 26.

Relocation No.	Date	Drainage	Location S	T	R
1	7/10/81	Blackleaf Lick	11	26	9
2	7/23/81	Blackleaf Cr	NW 15	26	9
3	8/ 5/81	Massey Cr/Jones Cr	NW 33	26	9
4	8/11/81	Frazier Mtn	10	26	9
5	8/12/81	Frazier Mtn	10	26	9
6	8/13/81	Frazier Mtn	15	26	9
7	8/19/81	Massey Cr	NW 4	25	9
8	9/ 8/81	Massey Cr/Jones Cr	4	25	9
9	9/27/81	Waldron Cr	24	24	10
10	10/10/81	Mt Lockhart	SE 14	25	10
11	10/22/81	Mt Lockhart	NE 14	25	10
12	11/13/81	Mt Lockhart	SE 14	25	10

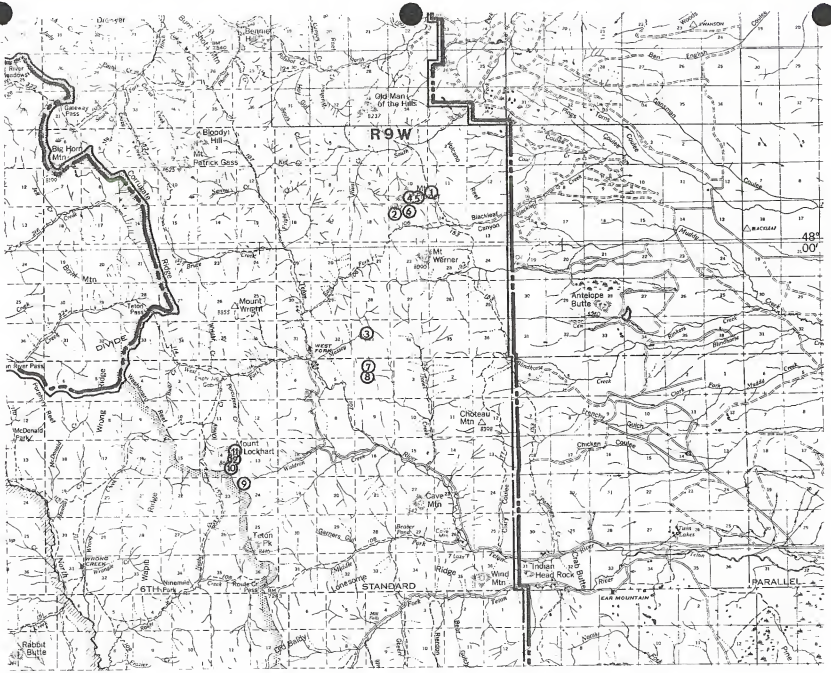

Figure 20. Relocations of yearling female mountain goat, no. 26.

Table 11. Relocations of yearling female mountain goat, no. 30.

Relocation No.	Date	Drainage	Location S	T	R
1	7/20/81	Mt Frazier	11	26	9
2	7/23/81	Mt Frazier/Blackleaf	NE 16	26	9
3	8/ 5/81	Massey Cr/Jones Cr	NW 33	26	9
4	8/19/81	Massey Cr	NW 4	25	9
5	9/ 2/81	Massey Cr/Jones Cr	33-34	26	9
6	9/ 8/81	Massey Cr/Jones Cr	33-34	26	9
7	9/27/81	N Fk Teton	4	25	9
8	10/10/81	Massey Cr	NE 32	26	9
9	10/22/81	Massey Cr	SE 28	26	9
10	11/13/81	Massey Cr	NE 33	26	9

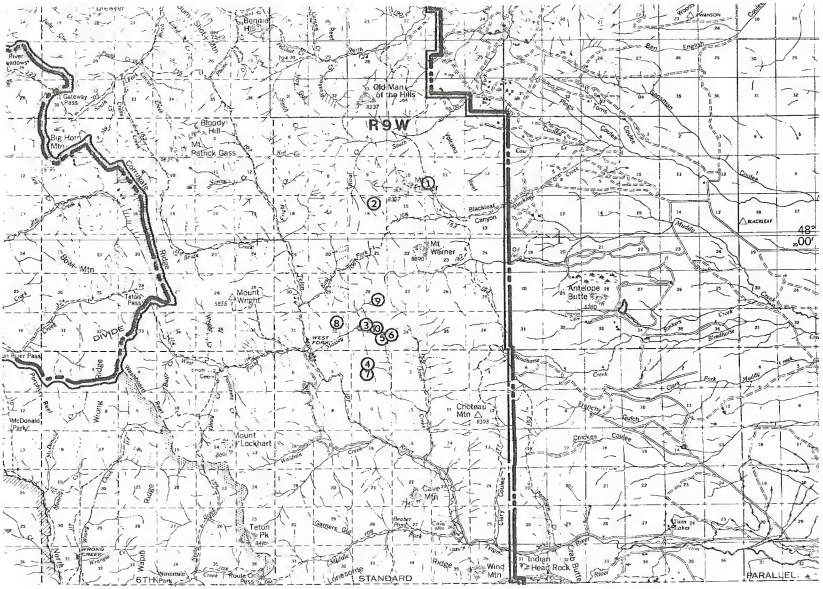

Figure 21. Relocations of yearling female mountain goat, no. 30.

Table 12. Relocations of yearling male mountain goat, no. 13.

Relocation No.	Date	Drainage	Location S	T	R
1	7/20/81	Mt Frazier	11	26	9
2	7/23/81	S Fk Dupuyer	NE 5	26	9
3	8/ 4/81	S Fk Dupuyer	NW 5	26	9
4	8/19/81	Mt Frazier	SE 10	26	9
5	8/23/81	Mt Frazier	10	26	9
6	9/ 2/81	Jones Cr/Massey Cr	33-34	25	9
7	9/ 8/81	Mt Werner	22	26	9
8	10/10/81	S Fk Dupuyer	NW 5	26	9
9	10/22/81	Hoy Gulch	SE 31	27	9
10	11/13/81	Mt Frazier	NE 16	26	9

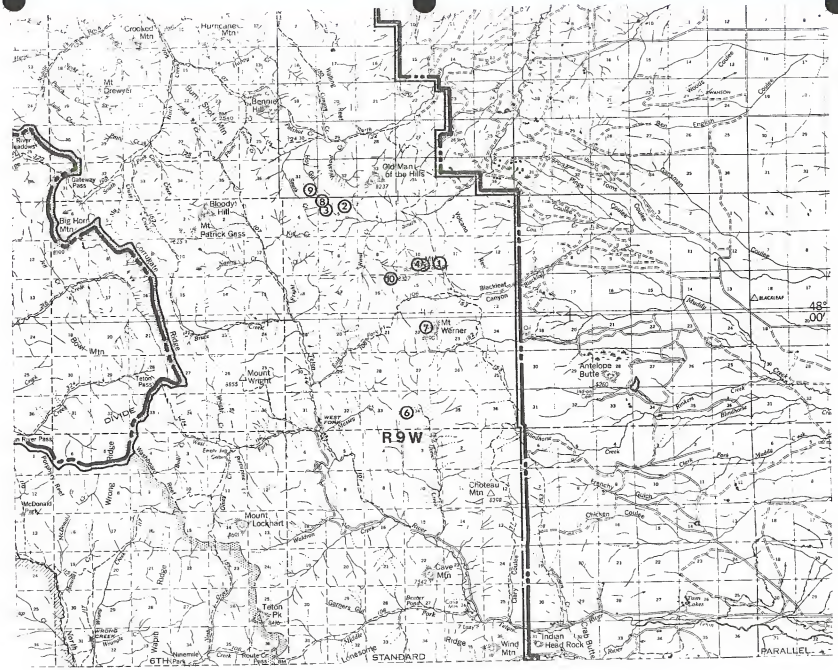

Figure 22. Relocations of yearling male mountain goat, no. 13.

Table 13. Relocations of yearling female mountain goat, no. 12.

Relocation No.	Date	Drainage	Location S	T	R
1	7/27/81	Mt Frazier	11	26	9
2	8/ 5/81	Massey Cr/Jones Cr	NW 33	26	9
3	8/11/81	Frazier Mtn	15	26	9
4	8/19/81	Massey Cr	NW 4	25	9
5	9/ 2/81	Massey Cr/Jones Cr	33-34	25	9
6	9/ 8/81	Massey Cr/Jones Cr	33-34	25	9
7	9/27/81	N Fk Teton	4	25	9
8	10/10/81	Massey Cr	NE 32	26	9
9	10/22/81	Massey Cr	SE 28	26	9

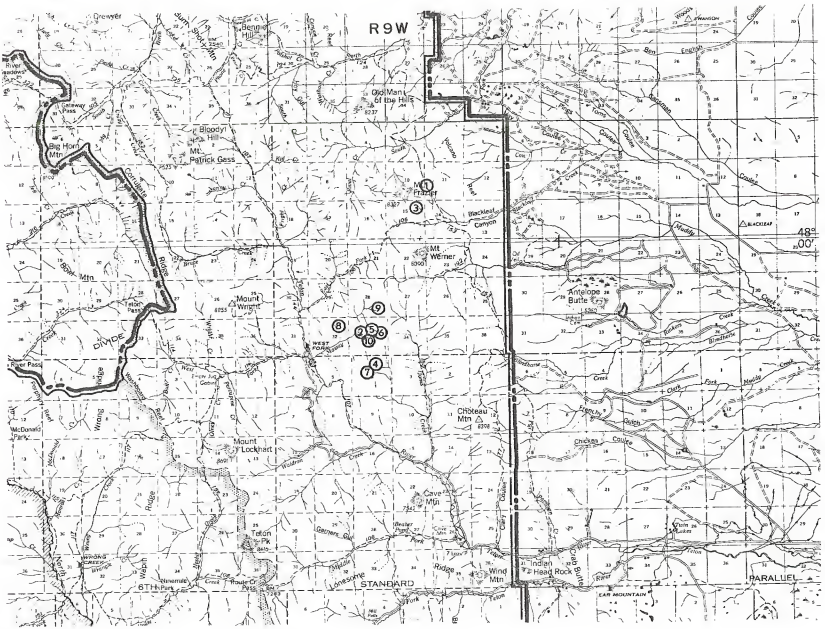

Figure 23. Relocations of yearling female mountain goat, no. 12.

Table 14. Relocations of two-year-old male mountain goat, no. 88.

Relocation No.	Date	Drainage	Location S	T	R
1	7/27/81	Blackleaf Lick	11	26	9
2	8/ 4/81	Mt Frazier	15	26	9
3	8/ 5/81	Mt Frazier	15	26	9
4	8/ 5/81	Mt Frazier	15	26	9
5	8/18/81	Mt Frazier	15	26	9
6	8/19/81	Mt Frazier	NW 15	26	9
7	8/23/81	Blackleaf Cr	NW 22	26	9
8	9/ 2/81	Muddy Cr/Jones Cr/ Teton	27	26	9
9	9/ 8/81	Blackleaf Cr	22	26	9
10	9/27/81	Walling Reef	17	27	9
11	10/10/81	Canyon Cr	NE 19	27	9
12	10/22/81	Walling Reef	SE 20	27	9
13	11/13/81	Walling Reef	NW 17	27	9

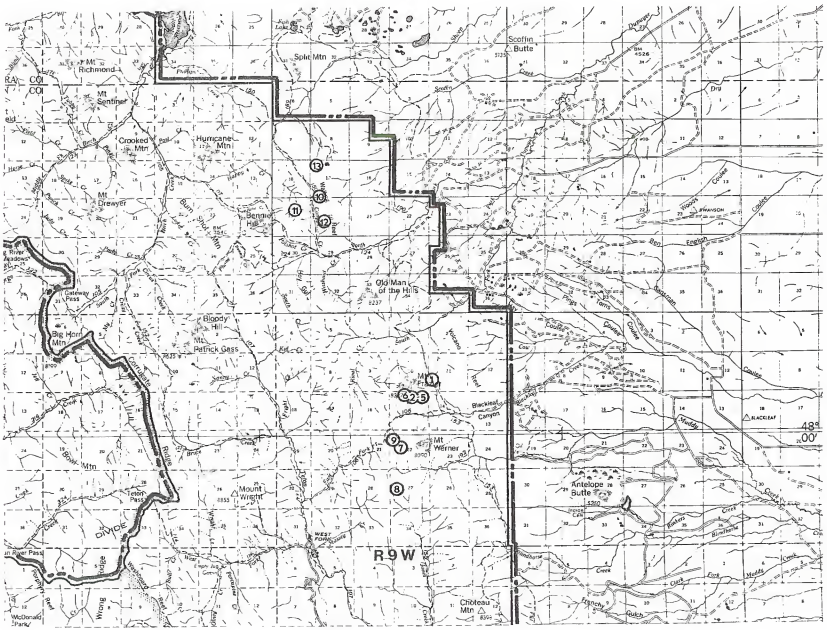

Figure 24. Relocations of two-year-old male mountain goat, no. 88.

Table 15. Relocations of three-year-old female mountain goat, no. 14.

Relocation No.	Date	Drainage	Location S	T	R
1	7/27/81	Mt Frazier	11	26	9
2	8/ 5/81	Massey Cr/Jones Cr	NW 33	26	9
3	8/11/81	Frazier Mtn	15	26	9
4	8/19/81	Massey Cr	NW 4	25	9
5	9/ 2/81	Massey Cr/Jones Cr	33-34	26	9
6	9/ 8/81	Mt Werner	N 22	26	9
7	9/27/81	N Fk Teton	4	25	9
8	10/10/81	Massey Cr	32	26	9
9	10/22/81	Massey Cr	SE 28	26	9
10	11/13/81	Massey Cr	NE 33	26	9

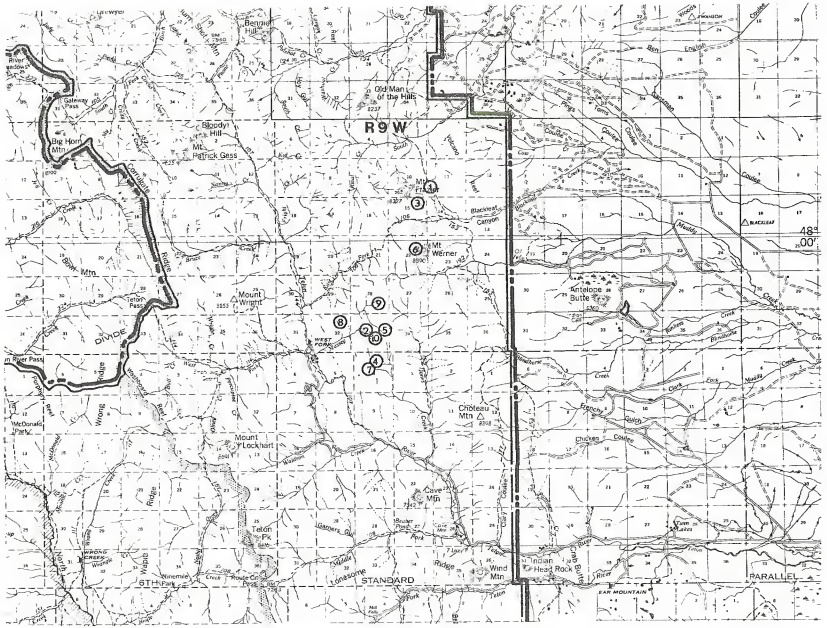

Figure 25. Relocations of three-year-old female mountain goat, no. 14.

Table 16. Mountain goats observed along the East Front during 1981 excluding helicopter surveys.

	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC	GRAND TOTAL
CLASSIFICATION 1/					
Total	37	110	193	39	379
Adult	23	55	97	20	195
Subadult	3	19	40	10	72
Kid	9	20	25	4	58
Unclassified	2	16	31	5	54
SLOPE 2/	N=37	N=110	N=193	N=39	
Over 70 %	100	56	3	5	
Under 70 %		44	97	95	
ELEVATION 2/	N=37	N=110	N=193	N=39	
5,900-6,500 ft.		45	2	10	
6,600-7,000 ft.	3	17	13	13	
7,100-7,500 ft.	64	18	47	26	
7,600-8,000 ft.	30	20	27	51	
Over 8,000 ft.	3		11		
ASPECT 2/	N=37	N=110	N=193	N=39	
N			10		
NE		1	20	2	
E	38	36	53	20	
SE	38	20	7	45	
S	3	7		33	
SW	16	1			
W	5	5			
NW			8		
Flat		30	2		
LAND TYPE 2/	N=37	N=110	N=193	N=39	
VI Peaks, Cirque	11	1	6	31	
VIIa Very steep, N, forested	3	6		5	
18 Scree		5			
71 ABLA(PIAL)/VASC	27	3			
161 FESC/AGSP		4			
171 ABLA/VASC & FESC/AGSP		171	12		
182 PSME/ARUV		1			
202 Rockland	59	35	82	51	

Table 16, continued.

	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC	GRAND TOTAL
TERRAIN TYPE 2/, 3/	N=33 2/	N=110	N=190	N=39	
Bluffs	52	10	39		
Cliffs	30	31	20	18	
Talus	61	57	42	28	
Broken		4		33	
Ridge		13	8	46	
Park		5			
Sidehill		35	12	10	
COVER TYPE 2/, 3/	N=33	N=110	N=190	N=39	
Timber	70	45	22	85	
Shrub		13	1	5	
Grass/Forb		20	10	8	
Rock/Bareground	30	36	83	5	
DISTANCE TO TIMBER 2/	N=33	N=110	N=165	N=39	
Less than 10 yd.	61	47	29	92	
10-50 yd.		11	2	3	
50-100 yd.		6	16		
Over 100 yd.	39	36	53	5	
DISTANCE TO ESCAPE 2/	N=35	N=110	N=177	N=38	
Less than 10 yd.	57	50	68	50	
10-50 yd.		10	9	24	
50-100 yd.		2	12	2	
Over 100 yd.	43	38	11	24	
DISTANCE TO ROAD 2/	N=33	N=110	N=190	N=39	
Less than 0.25 mi.		24			
0.25-0.5 mi.		1			
0.50-1.00 mi.		2	1	3	
Over 1.00 mi.	100	73	99	97	

1/ Figures given for classification are actual counts, not percentages.
2/ Results are given in percent.
3/ Total percentages may be more or less than the total number of goats observed either because an animal was observed in more than one location or because not all data for each observation could be collected.

Table 17. Habitat information collected during mountain goat helicopter surveys of the East Front, March and July, 1981.

	March 1981	July 1981
CLASSIFICATION 1/		
Total	185	135
Adult	110	72
Subadult	13	25
Kid	40	25
Unclassified	22	13
SLOPE 2/		
70 % or less	42	30
80 %	39	53
90 % or greater	19	17
ELEVATION 2/		
6,000-6,500 ft	1	
6,600-7,000 ft	13	4
7,100-7,500 ft	16	33
7,600-8,000 ft	39	44
Over 8,000 ft	31	19
ASPECT 2/		
N	3	17
NE	3	8
E	9	38
SE	6	6
S	26	13
SW	13	10
W	35	7
NW	5	2
LAND TYPE		
VI Peaks, cirques	54	23
VIIa Very steep, N, forested	1	2
18 Scree	3	2
182 PSME/ARUV	4	1
202 Rockland	38	72
TERRAIN TYPE 2/, 3/		
Bluffs	7	
Cliffs	33	52
Cirque headwalls		2
Talus	52	33
Broken	9	4
Ridge	14	6
Park	13	
Sidehill	3	32

Table 17, Continued.

COVER TYPE 2/, 3/		
Timber	29	32
Shrub	1	1
Grass/Forb	21	22
Rock/Bare ground	52	73
DISTANCE TO TIMBER 2/		
Less than 10 yd	29	28
10-50 yd		3
50-100 yd		14
Over 100 yd	71	55
DISTANCE TO ESCAPE 2/		
Less than 10 yd	49	61
10-50 yd	1	13
50-100 yd	5	5
Over 100 yd	45	21
DISTANCE TO ROAD		
Less than 0.25 mi		
0.25-0.50 mi		
0.50-1.00 mi		8
Over 1.00 mi	100	92

1/ Figures given for classification are actual counts.

2/ Results are given in percent.

3/ Totals are greater than 100 percent because data categories often overlapped; therefore a single observation may have been counted more than once.

Table 18. Location and description of mountain goat feeding sites examined during 1981.

DATE		LOCATION T	R	S	DRAINAGE	ELEVATION (Feet)	ASPECT
March	15	26N	10W	25	W Fk, N Fk Teton	7450	SW
	15	26N	10W	25	W Fk, N Fk Teton	7400	SW
	16	25N	9W	12	Jones Cr	8200	SW
	28	25N	9W	14	Jones Cr	7700	W
	28	25N	9W	14	Jones Cr	7650	S
April	2	25N	9W	34SW	S Fk Teton	6000	SW
	2	25N	9W	34SW	S Fk Teton	6100	SW
	11	25N	9W	26	M Fk Teton	6400	E
	30	26N	9W	10	Blackleaf Cr	6600	SE
May	23	25N	9W	34SW	S Fk Teton	6400	S
	24	26N	9W	10	Blackleaf Cr	6400	SE
	25	26N	9W	10	Blackleaf Cr	6600	SE
	25	26N	9W	11	Blackleaf Cr	6900	SE
	25	26N	9W	10	Blackleaf Cr	6300	S
June	2	27N	9W	35SE	S Fk Dupuyer	6200	SE
	5	26N	9W	14NW	Blackleaf Cr	6000	SE
	5	26N	9W	15	Blackleaf Cr	6400	SE
	5	26N	9W	10	Blackleaf Cr	6800	E
	22	25N	9W	7SW	Frenchy Gulch	6800	SE
July	5	25N	9W	1	Blindhorse	7700	E
	5	25N	9W	1	Blindhorse	7700	E
	22	24N	9W	20SW	S Fk Teton	7200	E
	22	24N	9W	20NW	S Fk Teton	7000	NE
	27	26N	9W	10	Blackleaf Cr	6800	E
August	19	26N	9W	15NW	Blackleaf Cr	7200	SE
	20	24N	9W	19	Headquarters Cr	7700	N
	20	24N	9W	19	S Fk Teton	7700	E
	21	27N	9W	21NW	N Fk Dupuyer	7500	N
	21	27N	9W	21NW	N Fk Dupuyer	7500	E
September	11	25N	9W	7SW	Frenchy Gulch	6600	SE
	11	25N	9W	12	Frenchy Gulch	7400	NE
	26	26N	9W	10	Blackleaf Cr	7000	E
	26	26N	9W	10	Blackleaf Cr	7500	E
	26	26N	9W	10	Blackleaf Cr	7000	E

Male mountain goat number 23 was captured July 23, 1979 as an 8-year old. His home range centers around Cave Mountain with July use of the Blackleaf lick (Table 8 and Figure 18). The fall rutting period was spent divided between the head of Jones and Muddy creeks and the head of Blackleaf and South Fork Dupuyer.

Female mountain goat number 72 was captured August 27, 1979 as a 4-year old. During each of 3 years she used the Blackleaf lick during June, July and/or August. Her home range centered around the head of the South Fork Dupuyer, with movements to the North Fork Teton and Muddy Creek (Table 6 and Figure 16). The 1981 kidding period was spent in the vicinity of Mount Frazier. The 1979 and 1980 breeding periods were spent in the East Fork North Fork Teton and Muddy Creek, respectively. A November 13, 1981 location was in South Fork Dupuyer.

Female mountain goat number 82 was captured August 27, 1979 as a 4-year old. Her summer range centers around the common heads of East Fork North Fork Teton, Blackleaf and South Fork Dupuyer, while her winter range tends slightly toward the south into Blackleaf, Massey and Jones creeks (Table 5 and Figure 15). The kidding period was spent in the North Fork Teton in the area between East Fork North Fork Teton and Kid Creek. The breeding period was spent in the South Fork Dupuyer, East Fork North Fork Teton, Blackleaf area.

Female mountain goat number 22 was captured July 24, 1980 at Our Lake as a 3-year old. Her home range centers around Rocky Mountain; however, the month of May was spent about 5 airline miles to the southeast in Billie Creek (a tributary of the North Fork Deep Creek). By June 11 she had returned to the Miner's Basin area. If she had a kid, it is not known where parturition took place. The breeding period was also spent in the Rocky Mountain vicinity (Table 9 and Figure 19).

July through November relocations were made on the six goats captured during 1981. Female yearling goats number 30 and 12 and 3-year old female goat number 14 used the same areas. Their center of activity focused around the head of Massey and Jones creeks (Tables 11, 13 and 15 and Figures 21, 23 and 25). Yearling female number 26 moved back and forth between Blackleaf Creek and Massey Creek twice before moving across the North Fork Teton to Mount Lockhart by late September, where she stayed (Table 10 and Figure 20). Yearling male number 13 moved from the Blackleaf lick to the North Fork-South Fork Dupuyer divide back to the Blackleaf lick and on south to Jones Creek, then Mount Werner and back to the North Fork Dupuyer (Table 12 and Figure 22). Two year old male mountain goat number 88 used the Blackleaf Creek drainage for a full month after being captured there, then he moved briefly to the head of Jones Creek. By mid-September, he was on Walling Reef. He stayed in this vicinity for the remainder of the relocations (Table 14 and Figure 24).

Movements of radio-collared goats were monitored as a seismic line was prepared along Blackleaf Creek during August 19-22. Activities of a seismic exploration company were first noted on August 19 when a flight was made to locate radio-marked goats. On that date, adult female goats

number 72 and 82 were located at the upper forks of Blackleaf Creek. Two year old male goat number 88 was located along the southern base of Mount Frazier and yearling male goat number 13 was found on the east face of Mount Frazier. On August 22, the company was still setting up its line. A trip was made to the head of Blackleaf Canyon to observe the blasting and the response of goats. The seismic activities were monitored all day, but the blasting which was planned did not take place. The adult female goats had moved out of the drainage, since the locations of 3 days previously. The 2-year old male was still present in the drainage and he was monitored all afternoon. The signal was first picked up along the base of Mount Frazier, then it was tracked as he moved out of the drainage along the South Fork of Blackleaf Creek and over the divide into either Jones Creek or the East Fork North Fork Teton. A late afternoon survey of the east face of Mount Frazier revealed the yearling male in the company of four other goats as they worked their way up the east-northeast cliff face of Mount Frazier and over into the South Fork Dupuyer Creek. These four radio-marked goats moved out of the Blackleaf drainage as seismic line preparations were made in the drainage. No blasting occurred, but the activity of about two dozen people, two pack strings carrying lines and equipment and one all-terrain vehicle appeared to have displaced the goats.

Habitat Description and Use

Seasonal Habitat Selection

During this investigation, observations of about 700 mountain goats were made. Specific habitat data were noted for each observation. Three hundred seventy nine goats were observed during ground reconnaissance and in association with radio-collared individuals (Table 16). Since these observations were not systematically collected, they were not used to describe habitat use. The aerial observations made during March and July were collected systematically from throughout the entire study area, so habitat use information is compared between these two flights. Table 17 presents this information comparing March (winter) versus July (summer) mountain goat use of the area. Mountain goat use of slope and elevation were not markedly different between the surveys, although the lower elevations appeared to receive slightly more use during winter. Use of aspect, however, does reflect a seasonal preference for south and west slopes during winter as compared to north and east aspects during summer. The remaining data categories do not appear to show much difference between seasons, although it should be stressed that the winter of 1980-81 was unusually mild and allowed wide dispersal of goats on sites which may be unavailable because of snow conditions during a normal winter.

Vegetation Analysis

Mountain goat feeding sites were examined from March through September by observing goats feeding at five different locations each month (four during April), then hiking to the site and establishing 15 2x5 decimeter frames along the approximate course the goats fed. Through this process the canopy cover of each species within 510 frames was recorded. Table 18

lists the location of each feeding site conducted during 1981. Voucher specimens of each species were collected for reference. A total of 162 species has been identified on feeding sites to date. Additional species identification is continuing. Sixty-six species of plants showed some evidence of having been fed upon by goats. Table 19 lists these species and indicates which species occurred in fecal samples. A comprehensive table will be prepared for a future report which gives canopy coverage and frequency of each species present on each plot. Analysis of 35 fecal samples using microhistological techniques was completed. Forty-five genera were identified in the samples, including trees - 3, shrubs - 8, forbs - 2, and grasses - 12. In addition, three unknown categories, the family Crucifera and root plant parts were included. Table 19 notes each genera which was identified in the fecal samples. Additional genera which are not listed in Table 19, since they were not identified at feeding sites, include Populus, Trifolium and Vicia. If the five monthly samples are pooled and a comparison is made by month of the forage categories browse, forbs and grasses, some seasonal preferences appear to emerge. During the months of March, April and May shrubs and grasses vied for first and second place in the diet, with forbs trailing far behind in third. In June grasses were by far the most common type of forage in the diet, followed by forbs and browse. During July, August and September, forbs were most preferred with grasses and browse falling far behind in second and third place. From March through June Festuca was the species which ranked first in the samples. During July and September Shepherdia ranked first, while Astragalus was first during August. Since goats were observed feeding at each sampled site, it was assumed that the vegetation which showed signs of having been fed upon was consumed by goats, although bighorn sheep and mule deer were also known to occur in the vicinity.

MANAGEMENT IMPLICATIONS

Recommendations

The following management recommendations are based on research findings from other areas and on current knowledge of mountain goats in the East Front study area. It is anticipated that information will be collected on this herd for at least 2 more years; therefore, the recommendations are preliminary and subject to change. The following chart illustrates the months in which each phase of the mountain goat's life cycle occurs. Human activity should avoid these seasonal mountain goat use areas, at least during those periods which are defined in the recommendations which follow.

Table 19. Plant species recorded at mountain goat feeding sites from March through September, 1981.

SPECIES LIST 1/	Species Which Have Been Fed Upon	Species Occurring in Fecal Samples 2/
Tree Species		
Abies lasiocarpa	X	X
Pinus albicaulis	X	X
Pinus flexilis	X	
Pseudotsuga menziesii		X
Shrub Species		
Acer glabrum	X	
Amelanchier alnifolia		
Arctostaphylos uva-ursi	X	
Berberis repens	X	X
Douglasia montana		X
Dryas octopetala		X
Juniperus communis	X	X
Juniperus horizontalis	X	
Penstemon eriantherus		
Penstemon fruticosus	X	
Penstemon spp.	X	
Philadelphus lewisii	X	
Physaria didymocarpa		
Potentilla fruticosa	X	X
Prunus virginiana		X
Ribes sp.		X
Ribes viscosissimum		
Rosa sp.	X	
Rubus idaeus	X	
Salix sp.	X	X
Shepherdia canadensis	X	X
Sibbaldia procumbens		
Spiraea betulifolia		
Symphoricarpos albus		
Vaccinium globulare	X	
Forb Species		
Achillea millefolium		X
Androsace lehmanniana		X
Androsace septentrionalis	X	
Anemone multifida	X	
Anemone nuttalliana		
Antennaria alpina		X
Aquilegia sp.	X	
Arenaria congesta		X
Arenaria hookeri		
Arnica cordifolia	X	
Arnica sp.	X	

Table 19. Continued.

Forb Species	Feeding Sites	Fecal Analysis
Aster conspicuus	X	
Aster foliaceus	X	
Astragalus eucosmus		X
Astragalus misellus		
Astragalus vexilliflexus	X	
Balsamorhiza sagittata		
Besseya wyomingensis	X	X
Campanula rotundifolia	X	
Castilleja sp.	X	
Cerastium arvense		
Cerastium berringianum		
Cerastium vulgatum	X	
Cirsium sp.		
Claytonia megarhiza		
Clematis columbiana		
Clematis hirsutissima		
Clematis pseudoalpina		
Collinsia parviflora		
Compositae	X	
Delphinium sp.	X	
Draba sp.		
Draba oligosperma		
Draba oreibata		
Draba reptans		
Epilobium alpinum		
Epilobium angustifolium	X	
Erigeron compositus	X	X
Erigeron humilis	X	
Eriogonum sp.	X	X
Eriogonum ovalifolium		
Eriogonum umbellatum		
Erythronium grandiflorum		
Fragaria virginiana		
Frasera speciosa	X	
Galium boreale	X	X
Galium triflorum		
Gentiana calycosa		
Geranium viscosissimum	X	
Geum triflorum		
Hackelia floribunda	X	
Hedysarum sp.	X	X
Heracleum lanatum		
Heuchera sp.		
Heuchera parvifolia	X	
Hydrophyllum capitatum		
Hieracium cynoglossoides		X
Hieracium sp.	X	
Hypericum formosum		
Labiatae		
Liliaceae	X	

Table 19. Continued.

Forb Species	Feeding Sites	Fecal Analysis
Linum perenne		
Lithospermum ruderale		
Lomatium cous	X	X
Lomatium dissectum	X	
Lomatium triternatum		
Lupinus sp.	X	X
Mertensia oblongifolia		
Mitella sp.		
Mitella brewer		
Osmorhiza occidentalis		
Oxytropis sericea	X	
Parnassia fimbriata		
Pedicularis groenlandica		
Pedicularis sp.	X	
Penstemon attenuatus	X	X
Penstemon spp.	X	
Penstemon nitidus		
Phacelia hastata	X	X
Phlox sp.	X	X
Plantago sp.		
Polemonium pulcherrimum		
Polygonum bistortoides		
Potentilla sp.		X
Potentilla diversifolia	X	
Potentilla gracilis	X	
Potentilla ovina		
Ranunculus eschscholtzii	X	
Ranunculus glaberrimus		
Saxifraga bronchialis	X	X
Saxifraga rhomboidea		
Sedum lanceolatum		
Sedum roseum		
Senecio sp.		
Senecio triangularis		
Smilacina racemosa	X	
Solidago sp.	X	
Solidago multiradiata		
Taraxacum officinale		
Thalictrum occidentale		
Townsendia parryi	X	
Valeriana sitchensis	X	
Veratrum viride		
Viola sp.		
Woodwardia fimbriata		
Zigadenus sp.		
Zigadenus venenosus		

Table 19. Continued.

Grasses and Grass Like Species	Feeding Sites	Fecal Analysis
Agropyron caninum		X
Agropyron smithii		
Agropyron spicatum		
Agropyron sp.		X
Agrostis thurberiana		X
Bromus spp.	X	X
Calamagrostis purpurescens		X
Calamagrostis rubescens	X	
Carex geyeri		X
Carex rossii		
Carex sp.	X	
Danthonia intermedia		X
Deschampsia caespitosa		X
Festuca idahoensis	X	X
Festuca ovina	X	
Festuca scabrella		
Koeleria cristata		
Luzula sp.		
Phelum alpinum		X
Poa alpina		X
Poa pratensis		
Poa sandbergii		
Poa spp.	X	
Selaginella densa		
Stipa sp.		X
Trisetum sp.		X
Unknown grass	X	X

1/ This is a tentative list which will be augmented when the vegetation work is completed.

2/ Fecal plant material could be identified to genera only, therefore reference to the plants in this column is to the genus name and not necessarily the special species within the genus.

Months during which mountain goat key seasonal areas are used.

	Mountain Goat Key Seasonal Use Areas					
	Winter Range	Kidding Areas	Mineral Licks	Nursery Areas	Breeding Areas	Summer-Transitional Range
Jan	x					
Feb	x					
March	x					
April	x					x
May		x	x			x
June		x	x	x		
July			x	x		
Aug			x	x		
Sept				x		
Oct				x		x
Nov	x				x	x
Dec	x				x	

Habitat Integrity: Mountain goat herds within an area could be isolated if travel corridors or seasonal ranges are bisected by human activity (Joslin 1980).

Recommendation: Key seasonal use areas should not be bisected with roads, helicopter flight paths, seismic lines, or other developments which could segment the population. Seasonal travel routes of mountain goats should be protected with timing restrictions and site-specific considerations. Human activities in key mountain goat range should be limited to temporary, short-term actions such as seismic lines and recreational camping. Long-term activities such as livestock grazing, energy or mining developments or developed recreational sites should not be allowed. Energy exploration or development, if it must occur within goat range, will require close supervision of state and federal wildlife biologists.

Avoiding Displacement: Mountain goats may be displaced by human activities (Chadwick 1973).

Recommendation: Mountain goats were displaced by seismic activity during this investigation. Since individual mountain goats use a defined area year after year, and since portions of that area are important on a seasonal basis, the placement and timing of human activities is very important relative to the occurrence of other activities in the general area. In order to maintain a required level of security, energy exploration and other human activities should not occur simultaneously in adjacent drainages. At least one drainage between activities should be left undisturbed and a period of a week should follow the activity before a new activity is moved into the undisturbed drainage. This will allow goats some security during the period of disturbance plus a period of quiet after the disturbance which will allow them to

drift back into the areas from which they were displaced. For energy exploration in particular, stress will be somewhat alleviated if a period of quiet follows seismic activity in one drainage and before it begins in another.

Winter Range: All mountain goats occur on limited winter ranges which are defined by topographic and climatic conditions (Smith 1976).
Recommendation: Human activities should not be allowed on or near mountain goat winter ranges from November 1 through April 30.

Spring Green-up: Wildlife must be able to take full advantage of the first spring green-up of grasses and forbs (Hebert 1973). Female mountain goats, like other species of ungulates, reach their lowest point of energy deficit during the period of parturition and beginning of lactation (Moen 1978).
Recommendation: All forms of stress should be minimized during this time. Special emphasis should be made to enforce all restrictions on human activities from May 1 through June 30. Livestock grazing should not be allowed on mountain goat range during this time period.

Kidding Areas: Mountain goats need security and seclusion during the kidding period (Chadwick 1973).
Recommendation: All kidding areas should be identified and delineated with an adequate buffer zone and restrictions on human activity within these areas should be imposed from May 1 through June 30.

Nursery Areas: Mountain goat nursery areas are extremely important in that they provide the type of habitat, security and forage which nursery groups are selecting (McFetridge 1977). A large portion of the mountain goat population occurs within nursery areas from June into October.
Recommendation: Nursery areas are one component of key summer range. Nursery areas have been tentatively defined. Human activities in nursery areas should be kept to a minimum. Seismic activity in a particular nursery area should be accomplished with few people and as quickly as possible. Activities should not occur in nursery areas during June. Individual nursery areas should not be disturbed more than once per month (1 week per month) from May through October.

Mineral Licks: Mountain goats have physiological requirements for salt from May through August and are attracted to artificial lick sites (DeBock 1970, Knight and Mudge 1967).
Recommendation: Efforts to identify all lick sites within the study area should be made. Energy exploration or development should not be allowed on mineral lick sites. Energy activities in the vicinity of mineral licks should not be allowed from May 1 through August 31. Livestock use of mineral licks during this period should be should be staggered so that all licks in an area are not used simultaneously. Mineral licks established for livestock can create concentrations of mountain goats. Consultation between biologists and those establishing lick sites should be done in order to determine where licks might be placed so that goats are not attracted into areas where they become vulnerable.

Road Access: The proliferation of road access into mountain goat range has led to mountain goat declines (Phelps et al. 1975).

Recommendation: Roads constructed for any purpose within mountain goat range should be of minimum standards and then obliterated and reclaimed after they have served the purpose for which they were originally constructed. Access into mountain goat range should be on foot, by horseback or from the air, rather than by vehicles which require roads.

Helicopter Use: Wildlife will panic from the approach of aircraft, particularly helicopters (McCourt et al. 1974, Miller and Gunn 1979). Mountain goats have been observed falling from cliffs when approached by helicopters (Joslin 1980).

Recommendation: Helicopters should strictly adhere to designated flight corridors specified for each seismic line by a team of state and federal biologists with input regarding safety from the seismic company or helicopter pilot. The flight paths should coincide with seismic line placement. Flight variability within that corridor should not be more than 1/4 mile either side of the line. More restrictive corridors may be identified for local areas when more protection for mountain goats is necessary.

Other Recommendations: Mountain goats are vulnerable because of their inflexible behavior. This behavior should not be interpreted as "adaptability." All measures should be taken to minimize observability of goats by people through the previous recommendations. These recommendations must be applied on an individual basis in order to adequately protect mountain goats.

The Lewis & Clark National Forest's environmental assessment on oil and gas leasing on nonwilderness lands should be amended to include current information and recommendations concerning mountain goats.

Mountain goat seasonal range delineations should be incorporated into the data base of the Lewis & Clark National Forest for use in forest planning.

Additional Data Needs

Continued monitoring of mountain goats along the East Front is necessary to fill the several information gaps which exist and to determine the effectiveness of the above recommendations. The six types of mountain goat use areas described previously (knowledge of which is essential to proper management of mountain goats) have not been fully delineated for the East Front study area. In fact, none of the kidding or breeding areas have been located and only some of the winter and summer ranges, nursery areas and mineral licks have been mapped. In addition to key winter and summer ranges which identify critically important seasonal concentration areas, overall winter and summer ranges must be mapped in order to provide the overall continuity of yearlong goat distribution necessary to adequately manage the East Front mountain goat population as a whole. Managing individual herd units rather than the East Front population as a whole may risk isolation of individual herds.

Efforts must be made to identify the important use areas of years past which, from a brief overview of the literature, are known to differ somewhat from those of the present. Knowledge of past mountain goat distribution and abundance along the East Front will provide a basis to compare current distribution and abundance and from which to set management goals.

In order to specifically define mountain goat use areas and provide recommendations to minimize conflict with people, individual mountain goats should be monitored through:

1. Biotelemetry techniques in order to determine:

    a. Life histories of individuals which should provide insights into the population dynamics of the herd as a whole (i.e., longevity, whether females reproduce each year, whether female young adopt their mother's home range, male's attendance in different female groups during the mating season, etc.).

    b. Seasonal use areas for specific individuals (winter range, summer range, kidding areas, breeding areas, mineral licks).

    c. Individual home range size.

    d. Survival of young which are collared and the extent to which yearlings pioneer new areas.

    e. Delineation of herd units.

    f. Movements in relation to human disturbances and modification of established use areas.

2. Seasonal mountain goat helicopter surveys to monitor seasonal use areas, abundance, distribution and population trends and dynamics.

3. Seasonal food habits analyses to identify vegetation species occurring on goat range, mountain goat food items and insights into food preference and feeding site selection.

An important aspect of mountain goat work along the East Front is not only to provide detailed range use by mountain goats of the area and provide recommendations to avoid unnecessary conflicts, but also to monitor mountain goats as developments take place to determine whether the recommendations are functioning to avoid or minimize impacts. It may be determined that the recommendations are either inadequate, or overly restrictive and in either case they should be modified. Up-dating and refining the recommendations will ensure that mountain goats are receiving a level of management concern which corresponds to the level of potential human impact and habitat disruption. Monitoring of mountain goats resulting in a better understanding of their ecology is a prerequisite to the continued survival of the native mountain goat population along the East Front.

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Appendix 1. Mountain goat observation form and code sheet.

OBSERVATION FORM

SPECIES

OBSERVER

PAGE ___ OF ___

		LOCATION				NUMBER								SITE DESCRIPTION							WEATHER							
DATE	TIME	DRAINAGE	SECTION	TOWNSHIP	RANGE	TOTAL	ADULT	SUBADULT	KID	UNCLASSIFIED	ACTIVITY	TIME OBS	DIST. ESCAPE	DIST. TIMBER	DIST. ROAD	TERRAIN TYPE	COVER TYPE	HABITAT TYPE	ELEVATION	ASPECT	TEMPERATURE	CLOUD COVER	WIND SPEED	PPT. TYPE	PPT. RATE	GROUND COND.	REMARKS

Appendix 1. (Continued)

OBSERVATION CODE SHEET

DATE 6-1-79
TIME 18:30
DRAINAGE N. Fk. Bull R.
SECTION 26
TOWNSHIP 28
RANGE 32

TOTAL 9
ADULT M1 (preface each number
F2 entry with M, F, or U
U2 for sex of animal)
SUBAD U1
KID U2
UNCL U1

ACTIVITY (up to 3 activity codes may be used eg: 123 = standing, bedded, feeding)
1 standing
2 bedded
3 feeding
4 running
5 drinking
6 dead
7 track
8 hair
9 pellet group

TIME OBSERVED in minutes

DISTANCE TO ESCAPE TERRAIN (see terrain type marked with * which indicate mountain goat escape terrain)
1 less than 10 yards
2 10 - 50
3 50 - 100
4 over 100

DISTANCE TO TIMBER
1 less than 10 yards
2 10 - 50 yards
3 50 - 100 yards
4 over 100 yards

DISTANCE TO ROAD (a road is defined as vehicle right-of-way which is passable at the time which the animal was observed)
1 less than 1/4 mi
2 1/4 to 1/2 mi
3 1/2 to 1 mi
4 over 1 mi

TERRAIN TYPE (see descriptions)
*1 bluffs
*2 cliffs
*3 cirque basin
4 talus slope
5 broken
6 ridge
7 park
8 creek
9 sidehill

COVER TYPE
1 timber
2 shrub
3 grass/forb
4 rock/bare

HABITAT TYPE (see list of codes and names below)

ELEVATION in hundreds of feet eg: 37 = 3700 feet

ASPECT
1 N 6 SW
2 NE 7 W
3 E 8 NW
4 SE 9 flat
5 S

TEMPERATURE
1 -0F
2 0 - 32
3 32 - 40
4 40 - 60
5 60 - 80
6 over 80

CLOUD COVER
1 clear
2 partly cloudy
3 mostly cloudy
4 overcast

WIND SPEED (Beaufort Numbers)

Number	MPH	Indicators
0	less than 1	smoke rises vertically
1	1 to 3	wind direction felt by smoke drift
2	4 to 7	leaves rustle
3	8 to 12	leaves, small twigs in constant motion
4	13 to 18	raises dust and loose paper
5	19 to 24	small trees in leaf sway
6	25 to 31	large branches in motion
7	32 to 38	whole trees in motion
8	39 to 46	breaks twigs off trees
9	above 47	structural damage

PPT. TYPE
1 rain
2 hail or sleet
3 snow
0 none

PPT. RATE
0 none
1 light
2 moderate
3 heavy

GROUND CONDITION
1 dry
2 damp
3 wet, muddy
4 scattered snow
5 snow (less than 6")
6 snow (6 to 12")
7 snow (over 12")

HABITAT TYPES
210 PSME/AGSP
220 PSME/FEID
230 PSME/FESC
250 PSME/VACA
260 PSME/PHMA
280 PSME/VAGL
290 PSME/LIBO
310 PSME/SYAL
320 PSME/CARU
350 PSME/ARUV
420 PICEA/CLUN
520 ABGR/CLUN
510 ABGR/XETE
530 THPL/CLUN
570 TSHE/CLUN
620 ABLA/CLUN
670 ABLA/MEFE
690 ABLA/XETE
830 ABLA/LUHI
850 PIAL-ABLA
860 LALY-ABLA

REMARKS
Cover and understory vegetation description important if habitat type unknown
any other pertinent information